JANUARY 1926—THIRTY-SECOND YEAR

MACHINERY

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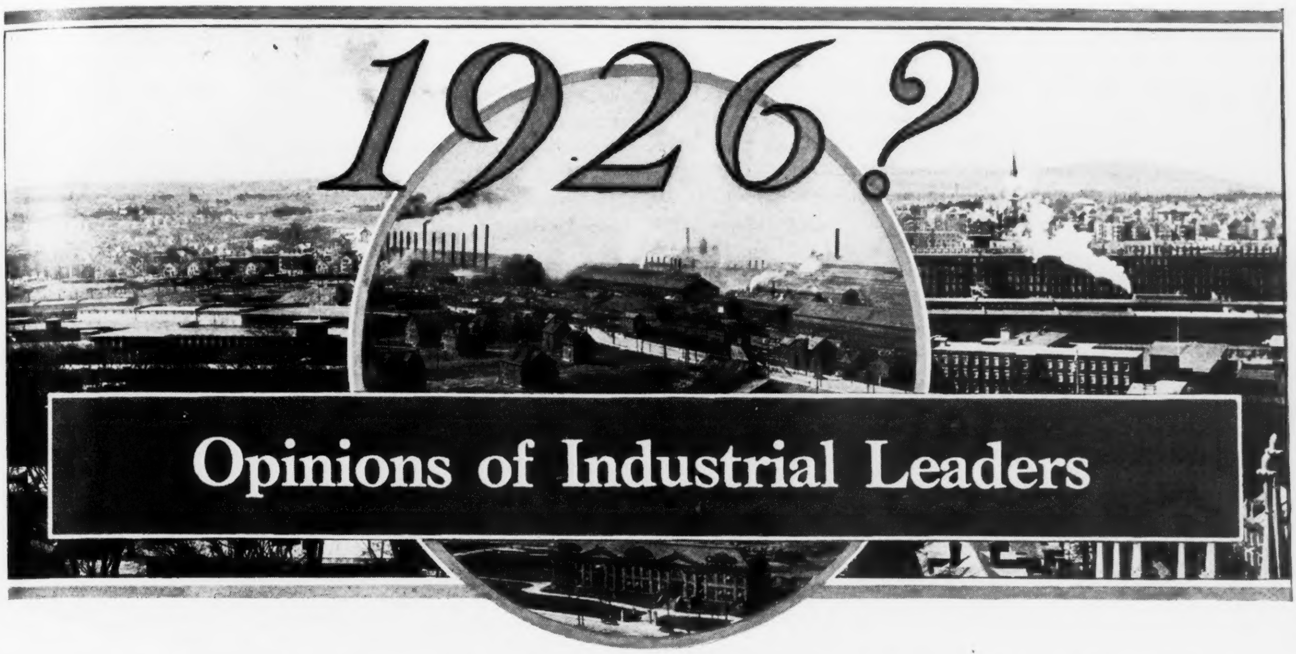


The Business Outlook as seen by Prominent Executives in the Principal Branches of the Machine-building and Metal-working Industries

THE end of 1925 finds the metal-working and machine-building industries at a more nearly normal level than in any period since 1914. During the last eleven years, these industries have experienced either a feast or a famine; but we have now entered on a period that promises a steadier and better balanced business.

In forming an estimate of the business of the coming year, and in making plans for the future, the opinions of industrial leaders in different branches of the industry furnish a most reliable guide. MACHINERY has, therefore, obtained the following first-hand statements from a large number of men prominently identified with different branches of the metal-working industries concerning the outlook for the coming year. In the opinion of these men, 1926 will be a year of comparatively good business.

Prices will have a tendency to advance, but the leaders in the field warn against too sudden price advances and over-production, as either of these would precipitate a slump in business for which there is no basic economic reason. A leading manufacturer puts this warning in the following words: "The only danger is that manufacturers, forgetting the lesson of 1920, will unduly raise prices of both raw materials and finished products, and then, tempted by these price increases, will begin to over-produce. The wise manufacturer will maintain his production just a little below the demand."

AIR TRANSPORTATION

By WILLIAM B. STOUT, President,
Stout Metal Airplane Co., Division of Ford Motor Co.,
Detroit, Mich.

There is no industrial field in which the development during 1926 will be so marked as in air transportation. Commercial aviation has actually arrived in the United States and will make great strides during the coming year. In 1925 the Stout Metal Airplane Co. built fifteen Stout air transports, and at the end of the year it reached a production of two a month. This production will be increased during 1926 to one plane a week of the large transport type. Production is now being started on the Tri-motor plane, which has three engines, each of 200 horsepower, or a total of 600 horsepower. These planes have a capacity for carrying twelve passengers with hand baggage, or a ton of express or freight.


William B. Stout, President, Stout Metal Airplane Co.

The safety and practicability of air transportation has been demonstrated during 1925. For nine months, there has been regular daily service between Chicago and Detroit, three single trips being made daily. For six months, service has been maintained between Detroit and Cleveland, one round trip being made every day. This service has been maintained in all kinds of weather, and only one day the scheduled trips were cancelled because of a fog so dense that not a single steamship went through the Detroit River for eighteen hours.

In the services mentioned, no accident of any kind has occurred, although an equivalent of 2,000,000 passenger-miles has been accomplished. During 1926, this service will be placed on a regular commercial basis, and it will be possible to carry passengers from Detroit to Chicago for $25, and from Detroit to Cleveland for $15. Ultimately, when the volume of traffic increases, it will be possible to carry passengers by plane as cheaply as by rail.

During the coming year, regular passenger lines will be placed in operation between Los Angeles and Salt Lake City, Los Angeles and Dallas, Tex., Chicago and Dallas, and Boston and New York. Three or four lines will also be placed in operation in Florida. The Stout Metal Airplane Co. has sold all the planes it can build up to next July for definite lines, planes being sold only to corporations who intend to use them for commercial purposes. No planes are sold to individuals.

At the end of five years, it is likely that the airplane-building business will be as big as, or bigger than, the combined motor truck and bus business is today, and it will begin to approach the automobile-building business in volume of production.

THE AUTOMOBILE INDUSTRY

By ALVAN MACAULEY, President, Packard Motor Car Co. Detroit, Mich.

The present conditions in the automobile industry are satisfactory. There is a good market ahead, but the outlook indicates that there will be an intensive competition for that market, as there are now many well equipped automobile manufacturers, each capable of bidding strongly for their share of the business. This competition in finding customers will have a tendency to encourage longer time payments. The time sales have not yet reached an unhealthy condition, but there is a tendency in that direction that must be watched. It is generally considered that safe terms call for one-fourth to one-third of the sales price as an initial payment, the balance being distributed in twelve equal installments. As yet, few sales have been made on terms that could be considered dangerous for these times, and while some bankers have raised the question of whether unduly liberal terms have not been granted, so far the banks have been the main beneficiaries, and the best business that they have enjoyed has come from the time sales of the automobile industry. It has meant a greater volume of business for the banks, both directly and indirectly.

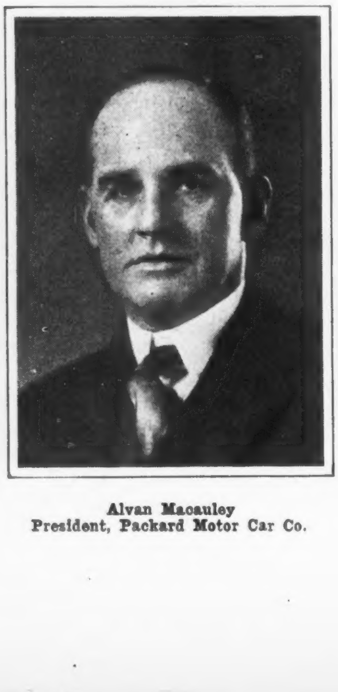
Great strides have been made during the past year in reducing the cost of building automobiles, while at the same time producing cars of higher quality. The benefits of the savings effected have immediately been passed on to the buyers.

It is likely that in 1926 the automobile industry will buy new equipment at about the same rate as in 1925, possibly more so. Automobile manufacturers will not need new buildings, but they will need new machine tools and facilities. Conveying equipment will be especially in demand, and there is considerable room for improvement in this direction. There will also be an increased demand for welding equipment, as the possibilities for welding in automobile construction have only begun to be realized. Generally speaking, the tendency will be toward the use of heavier machine equipment, as this permits of faster operation.

The output of automobiles this year will be well over 4,000,000 cars, and it is quite likely that the output next year will be 4,500,000 cars. There are no radical changes in sight, but a gradual, steady, mechanical development will probably characterize the automobile industry during the coming year.

By WALTER P. CHRYSLER
President, Chrysler Corporation, Detroit, Mich.

Every time I am asked what I think about the business outlook I recall the story of the banker who said there are two things about which he never makes any forecasts: The one is foreign exchange and the other the automotive business. So possibly, a manufacturer of motor cars is not eligible to make business forecasts. However, the automotive industry today ranks first among all of the country's manufactures, rated according to the wholesale value of production.



Alvan Macauley
President, Packard Motor Car Co.

There was a time when the steel industry was used as an economic barometer, and it is still a good one; but the automotive industry is equally good. Think of the industries that are more or less dependent upon it—iron and steel, cement, aluminum, plate glass, leather, rubber, lumber, copper, tin, lead, zinc, nickel, paint and varnish, cotton, wool, etc.

Walter P. Chrysler
President, Chrysler Corporation

The American automotive industry has just passed through a record year. Will 1926 be as good or better? Frankly, I don't know, but everything indicates it will be a good year. I am optimistic about the future. I see the probability of lowered taxes. Building operations are going ahead. Labor is fully employed. The agricultural outlook is good. Material prices may go upward, but the public will have increased capacity to buy. The Chrysler Corporation faces the future with genuine confidence. In 1924 we manufactured nearly 75,000 cars, and in 1925 more than 100,000. Next year we hope to go to 150,000.

There are those in the automotive industry who fear the probability of the extension of time allowed to make payments on cars sold on the deferred payment plan. They disapprove also of the sale of cars when less than 30 per cent is required to be paid down. Changes in the financing of cars sold on a time basis will come through improved methods of financing. During the past year the Chrysler Corporation inaugurated a plan of financing whereby the purchasers of Chrysler cars will be saved $5,000,000 in lowered finance charges and reduced insurance rates during the first year of the operation of the plan.

Obviously, no company is going to finance the sale of a car sold on the deferred payment basis unless that car is protected against loss from fire or theft during the period when payments on the car are being made; so blanket insurance was obtained also. Today it is no more possible to buy a Chrysler car without fire and theft insurance attached than it is possible to buy a Chrysler car without a motor.

If every business could look ahead with the same confidence that the automobile business can, we would indeed have cause to feel jubilant over the approaching year. But it will be a good year. Everything indicates that.

By EDWARD S. JORDAN
President, Jordan Motor Car Co., Cleveland, Ohio

The companies that have recently announced new models have operated at capacity during the fall months and will doubtless continue to do so throughout the winter, depending, of course, on sales and on how heavily the dealers stock up. On the other hand, some builders have reduced their output during recent weeks with the view of bringing out new models at the New York Automobile Show.

At the present time, there is no over-production of automobiles. The earnings of labor in practically all industries are high, and consequently, low-priced and second-hand cars have sold well during the past year. The activity of the second-hand market, in turn, has made it possible for the dealers to take old cars in trade, and the market for new cars has been active. When the second-hand market for cars becomes slow, it immediately also stops the sale of new cars, because a dealer cannot take old cars in trade unless he can sell them.

The outlook for the next six months, at least, is very good, depending upon favorable general business conditions, which insure employment at good wages in all industries. In the great basic industries, there is a very satisfactory activity with no over-production; farmers are in a better financial condition than they have been for years, and are selling their products at a price that is now on par with that of manufactured products. The favorable conditions in

Edward S. Jordan
President, Jordan Motor Car Co.

the steel industry and in the railroad field are other important factors. The railroads, not being harassed by unfavorable legislation and being permitted to operate on business principles, are beginning to earn a fair return on their investment. Their prospects for the coming year are good, the freight traffic especially promising to reach record figures. This, in turn, means good earnings for railroad employes, which will influence the wage throughout industry and produce a good buying power. This, in turn, will make the automobile industry prosperous during 1926, because of the favorable second-hand market that it creates.

The point to keep in mind at this time is the importance of maintaining the present balance in business. If manufacturers are tempted by increasing demand to raise prices, there is likely to be over-production with inflated prices all along the line, and this will end only in a slump; but if production is kept slightly below the demand, we will have a good year throughout 1926. On the other hand, there is a possibility that manufacturers will forget the experience of 1921 and will over-produce, in which case the dealer will be unable to handle the surplus, as he cannot take in second-hand cars sufficient to maintain the necessary balance.

The watchword, therefore, is: "Keep production at a level where demand is just a little greater than production, and we will be on the safe side."

By J. R. HALL
Vice-president in Charge of Production, Chandler Motor Car Co., Cleveland, Ohio

The general prosperity of the automobile industry in 1925 has been shared by the Chandler Motor Car Co., its business for 1925 exceeding that of 1924. Particularly was there an extraordinary response to a new line of cars, all at lower prices, introduced to the Chandler dealers and distributors at a convention held on September 10. It was the most extraordinary response that this company has ever known and, as a result, the last quarter of 1925 will be the biggest of the year, which is a most unusual development, as volume is generally greatest in the second quarter. The new cars found the dealers and distributors almost without any stock of the old models. Therefore, this company goes into 1926 with every reason to expect a material increase of sales. Generally speaking, the automobile industry will not need to increase its plant capacity to take care of the bigger indicated volume in 1926.

The distinctive feature of 1925 is, of course, the marked increase in the demand for closed cars. This demand has had a most valuable influence in the direction of stabilizing production. It means that the industry escapes from seasonal buying on the part of the public and does its business more evenly throughout the year. In the days when the open car dominated the industry, most of the selling was done in the warm months, and the fall and winter business saw a sharp reduction. Now the tendency toward closed cars means that the business carries into the fall and winter months.

Thus we see the Chandler Co. having its biggest month in November, and industry, as a whole, making a new production mark in the month of October. This is naturally one of the most healthy developments for the automobile industry. It means that the all-year and all-weather car makes the automobile business an all-year balanced business. The proportion of the number of automobiles used for purely business purposes is constantly growing, and this also has a tendency to spread the business over the entire year and to eliminate the peaks and valleys of production that formerly were dominant in the industry. These conditions all seem to combine to make a most optimistic outlook for 1926.

CHAIN AND CONVEYING EQUIPMENT

By CHARLES PIEZ
Chairman, Link-Belt Co., Chicago, Ill.

The business of the Link-Belt Co. has been approximately 10 per cent greater during the past year than it was in 1924. On the whole, the situation has been satisfactory, although prices have been on a narrower margin than previously, and hence profits have not increased in the same proportion as the volume of sales. The average reduction in prices during the year has been about 5 per cent.

All conditions in the industrial and transportation fields in general are so satisfactory that it is safe to assume that the business for the next six months, at least, will equal the business of the last six months in 1925. Furthermore, there are no adverse conditions discernible at the present time that would indicate anything but satisfactory business for the remaining six months of 1926.

One of the outstanding conditions that have influenced the industry in 1925 has been the exceptionally good transportation that has been furnished. As an example, it may be mentioned that transportation has been so dependable that the branches of the Link-Belt Co. on the Pacific coast are now able to carry smaller stocks than it was safe to carry formerly, and yet are able to meet the requirements of the company's customers as satisfactorily as before. As long as transportation continues as good as it is, buying will probably continue to be from hand to mouth, which has been a feature of the buying during the past year. There is a constantly greater number of transactions for the same total volume of business.

Briefly, the conditions for a stable business are more favorable at this time than at any time since the war. Prices are moderate, there are no indications of inflation, there are no excessive stocks on hand, and while competition is more aggressive, that is merely conducive to greater alertness and efficiency. It is likely that when complete statistics are available it will be found that 1925 has been the biggest year in volume of production of American industries; and there is every reason to believe that 1926 will equal it.

THE DIE-CASTING INDUSTRY

By CHARLES PACK
Vice-president, Doehler Die Casting Co., Brooklyn, N. Y.

The die-casting process is becoming universally recognized as one of the important methods available for the manufacture of metal parts. This process was highly experimental fifteen years ago, but today every mechanical and electrical engineer gives consideration to the use of die-castings in the design of mechanical and electrical apparatus. It is evident, therefore, that recent and future progress in the die-casting art is dependent largely upon the progress made in various lines of manufacture using metal parts in large quantities.

Charles Piez
Chairman, Link-Belt Co.

The die-casting industry of today owes its success mainly to the devel-

opment of the automotive industry, where quantity production of metal parts is an essential factor. It is safe to say at least fifty per cent of all die-castings manufactured are used in automotive equipment. Ten years ago the phonograph ranked next to the automobile in the volume of die-castings used.

During the last two years, the constant development of the radio industry has placed the radio receiving set next to the automobile in relative importance as a user of die-cast parts. The outstanding feature of the past year in the die-casting industry has been the extensive application of die-castings to radio manufacture. The coming year will witness the introduction on a large scale of the combination phonograph and radio. Die-castings are used largely in the combination of these two useful instruments into one unit.

The commercial aspect of the die-casting industry at this time is confronted with serious difficulties in the form of high zinc and aluminum prices. In the adoption of a method for the production of metal parts, the modern engineer must of necessity carefully consider manufacturing costs. On a pound basis, die-castings cannot compete with foundry products, such as iron castings or even brass castings. Die-castings are, however, more accurate than sand castings, and the use of a die-casting in place of a sand casting invariably must depend upon the answer to the following question: Will the die-casting save sufficient machining operations to pay for the additional cost as compared with sand castings? It is evident that the answer to this question depends to a large extent upon the cost of the raw materials involved in the processes.

J. S. Gullborg, President
Alemite Die-casting & Mfg. Co.

The die-casting industry will continue to grow with the other metal industries only if the prices of zinc and aluminum remain constant or are reduced to previous levels. On the other hand, further increases in the cost of these two important elements will not only prevent the growth of the die-casting industry, but may reduce the economic value of the process to a point where it will cease to be an important factor in the metal industries.

By H. C. SKINNER
General Manager, Franklin Die-Casting Corporation, Syracuse, N. Y.

The outlook in the die-casting industry for 1926 is most encouraging. The die-casting process applies to a very wide range of products, including practically all branches of the automotive industry, dairy equipment, radio (in which field the possibilities of die-castings are just beginning to be realized), electrical devices, musical instruments—especially phonographs—and to a great many other lines.

While it is not believed that the orders received from users of die-cast products indicate any tendency on the part of manufacturers to anticipate their requirements beyond a conservative degree, yet there is every evidence that plans are being made for an active year. The question of price is probably entering into purchases to a greater degree than at any previous time, but this is true of buying in general, and is the result of the keen competition throughout the entire industrial field. It is difficult at this time to state the probable percentage of increase in the die-casting business for 1926 over 1925, but it would not be surprising to see an increase of 25 per cent, or possibly 50 per cent.

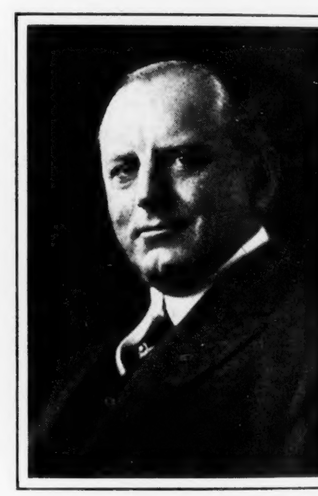
By J. S. GULLBORG
President, Alemite Die-Casting & Mfg. Co., Chicago, Ill.

The activity in the die-casting industry in 1925 has probably been from 25 to 30 per cent greater than in 1924. In individual cases, there has been an even greater increase than this, some plants having practically doubled their volume. Present indications point to an active year in 1926, with an increase in business for the entire industry at about the same rate as in 1925.

The price situation has been more satisfactory during the past year than it was in 1924, and plants well equipped for handling their business have been able to make a satisfactory profit. Some of the smaller concerns in the industry, on the other hand, have been unable to compete successfully with the more completely equipped plants, and have gone out of business.

One of the outstanding features in this industry at the present time is the scarcity of the No. 12 aluminum alloy generally used for die-castings. This scarcity has caused an increase in price, and is likely to continue for some time to come.

As an indication of the growth and development of this industry, it may be mentioned that die-castings of very large dimensions are now being made regularly. Six or seven years ago, die-castings were comparatively small. At that time, the maximum size of die, as a rule, was about 6 inches square. Now, it is not unusual to employ dies as large as 24 inches square, and even larger dies have been made. As has been frequently pointed out, when the quantity is large enough to absorb the die cost, there is nothing prohibitive in the expenditure for even very complicated dies, because they are usually good for a production of at least 25,000 castings or more. Basing the quantity on 25,000 castings only, the die cost per unit casting is usually far less than would be the cost of tooling up and performing a number of operations; besides, greater uniformity and accuracy in dimensions of the product are obtained.



Charles E. Adams
President, Cleveland Hardware Co.

THE DROP-FORGING INDUSTRY

By CHARLES E. ADAMS
President, The Cleveland Hardware Co., Cleveland, Ohio

In the drop-forging business, the status of the transportation industry, (automobile, truck, bus, tractor, and railroad fields) is a determining factor; hence it is expected that the drop-forging business will be quite satisfactory in 1926.

During the past year the volume of business in this line has been from 10 to 25 per cent better than in 1924, and there is every reason to believe that next year should be as good or better. The prosperity of the farmer, due to the very good crops harvested this year, will have a marked influence on the industrial conditions during the coming year. Furthermore, the use of drop-forgings is constantly increasing, the tendency being to lighten and strengthen not only automobile parts, but parts of a great variety of industrial equipment, by replacing castings by forgings. Gradually, therefore, the industry will be likely to meet the plant capacity available. At the present time, however, the plant capacity is greater than the demand, and hence competition in this, as in many other fields, is very keen and prices extremely close. The drop-forging industry was greatly ex

panded during war times because war equipment calls for the strength and durability which only drop-forgings can give.

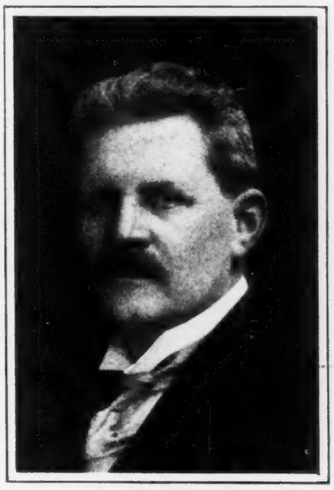
The tendency in the automotive field is to follow that of the carriage, wagon, and railroads, which maintained their own forging plants and foundries, in an endeavor to produce everything entering into the manufacture of their equipment; but while some of the large automobile producers are just entering the drop-forging field, others are already finding that there is an advantage in having a large range of sources of supply and the engineering skill of the commercial plants; and this, in addition to the demand on the part of the buyer for greater strength coupled with lightness of vehicles, gives every reason for a largely increased field for the so-called commercial drop-forge plant.

THE ELECTRIC TOOL FIELD

By S. DUNCAN BLACK
President, Black & Decker Mfg. Co., Towson, Md.

The outlook for the next year in the portable electric tool field is very promising. There is no apparent reason why good business should not continue throughout 1926. Our volume of business for 1925 has been 20 per cent greater than in 1924; and using 1924 again for comparison, we expect our volume of business in 1926 to be 40 per cent greater. It has been necessary to add plant capacity, and it is expected to further increase our capacity in 1926, probably to the extent of 25 per cent.

The outstanding factor favorably affecting the portable electric tool industry is the educational work carried on by this industry. Almost every operation previously performed by hand tools is now being done better and quicker by portable electric tools. As an example might be cited the growing use of portable electric screwdrivers. This application of the portable electric tool has speeded up production remarkably. For instance, in an automobile body plant, five No. 12 wood screws, 1 1/2 inches long, are driven securely home without marring or scratching either the screw head or the wood, in six seconds. Equally remarkable applications are found in the tightening and removing of nuts, the tapping of holes, and in drilling and reaming operations.



H. Harnischfeger
President, Harnischfeger Corporation

ELEVATING, HOISTING AND CONVEYING MACHINERY

By A. C. BROWN
President, Brown Hoisting Machinery Co., Cleveland, Ohio

In the hoisting and conveying machinery field, the demand for equipment is due mainly to three reasons: (1) Equipment is installed primarily as a matter of economy, with a view to replacing labor; (2) equipment is installed by necessity, when the supply of labor becomes limited and the only way in which the work can be handled is by providing mechanical equipment; (3) equipment is installed when industries are enlarged or new industries start and equipment is required for expansion purposes in connection with new plants or factories.

During 1925, this branch of the machine-building industry was characterized by an increasing volume of business, the primary reason being the need for economy of operation, regardless of whether there was a labor shortage or not. This need for economy of operation is always present, but it was more keenly felt during the past year on account of competitive conditions. On the other hand, there was no great scarcity of labor and no appreciable amount of expansion business. Hence, in order to sell hoisting and conveying machinery, the manufacturers in that field had to figure on a very low price basis, so that in 1925, in spite of the fact that the volume of business was probably 20 per cent greater than during the preceding year, this advantage in volume was largely offset by decreased prices.

The outlook for 1926 is somewhat better. It now seems as if all three reasons for buying hoisting and conveying equipment would influence buyers during the coming year, and that being the case, it is likely that the price situation will be somewhat improved.

During the past year the demand has been largely for locomotive cranes, steam and gas shovels, buckets, conveyors, and what might be generally termed standard machinery. The demand for dock machinery and coal and ore-handling equipment has been somewhat below normal, because special equipment of this kind is mainly required for expansion purposes and is generally bought by big corporations only when business expands. It is likely that in 1926 there will be an increased demand for the latter class of equipment, while the demand for the former type will considerably increase. In conclusion, therefore, it may be said that there is every reason to look forward to 1926 with confidence. The promise of 1926 is good.

By A. T. PERKINS
Vice-president and General Manager,
The Webster Mfg. Co., Chicago, Ill.

During the past year the volume of business in the elevating and conveying equipment field has been fair, but the selling prices have been too low and labor costs as high as ever, while the prices of materials have advanced, with the result that the percentage of profit in this industry is at present critically low. The volume of business, in our experience, has fallen off from the year 1924 approximately 15 per cent. The prospects for 1926 are good, although most firms will not enter the new year with as large a volume of orders on their books as they had at the beginning of 1925. We hope the volume in 1926 will be about the same as 1924, or better. One line of equipment that has been and promises to be unusually heavy is that for cement industries, due to the extensive road-building programs and building constructions now under way.

The problems that have confronted manufacturers in this field during the past year have mainly related to whether losses would be least by taking orders at too low prices in order to meet some of the overhead costs, or whether it would be safer to take less business, and attempt to make a small profit on a smaller volume.

The makers of elevating and conveying machinery have made many improvements that are saving costs in other industries, as, for example, car dumpers for unloading grain and other materials, where the unloading cost is cut in half, but unfortunately the manufacturer of this equipment cannot use his cost-cutting devices to reduce costs in his own plant.

By H. HARNISCHFEGER
President, Harnischfeger Corporation, Milwaukee, Wis.

I consider that the outstanding factors affecting the volume of business in 1926 in the various fields covered by our products are the opening up of new markets and the improvement of general business conditions. The volume of business of the Harnischfeger Corporation in 1925 was approximately 20 per cent greater than that in 1924, and it is believed that the volume in 1926 will be approximately 10 per cent above that in 1925. We do not expect to enlarge our plant capacity to take care of this increase except by rounding out certain manufacturing facilities by adding new machine tools or replacing old machines by improved types.

By H. L. DONAHOWER
President, Standard Conveyor Co., North St. Paul, Minn.

I believe that during 1926 the greater purchasing power of the farming districts is going to be felt in industry in general. The absence of inflation, both in prices and inventories, assures a fairly steady flow of production. The absence of any abnormal conditions that would tend to stimulate buying places industry on a strictly competitive basis, and this condition is one that emphasizes the importance of cost reduction. Conveyors are strictly cost reducers, and aid in shortening the time necessary for converting raw materials into finished products, and in reducing labor costs in handling materials.

The business of our company in 1925 was about 10 per cent greater than in 1924, and the prospects for 1926 are that it will be another 15 per cent greater. Some additional plant capacity, which has already been provided for, will take care of this expected volume of business.

ENGINES AND HEAVY MACHINERY

By G. A. RENTSCHLER
President, The Hooven, Owens, Rentschler Co., Hamilton, Ohio

During 1925 there has been a greater demand for certain types of our products than there has been for other kinds of equipment. The demand for presses has been good, and business in special machines for various industries has been active. The demand for steam engines has about equalled that of 1924. On the other hand, the demand for sugar machinery has been smaller than in 1924, but the marine Diesel engine business has been fairly active. On the whole, the average business in the building of engines and heavy machinery has been satisfactory, and the prospects are that the volume of business in 1926 will equal that of 1925.

We find conservatism in placing orders for equipment to be charged to capital account. Few orders are placed far ahead of actual requirements; however, we have had a steady stream of new business.

There has been a great deal said about keen competition at the present time. It is true that competition is keen, but it can be successfully met by reducing the cost of production by the use of modern equipment. You cannot expect to hold your own in the competition of today in the heavy machinery field, if you enter into that competition with antiquated plant equipment.

Costs can be reduced by the use of modern machine tools, not only in plants able to produce in quantity, like the automobile plants, but in shops where only one or a few units of each machine are being built. The need for new equipment cannot be emphasized too much. The experience of the Hooven, Owens, Rentschler Co. has shown that by replacing numerous old machines by a smaller number of more highly efficient new high-production tools, costs can be sufficiently reduced to warrant the replacement.

We have been busy designing and building large-powered Diesel engines. One of 3300 horsepower, double-acting, two-cycle, will be ready for trial runs early in the spring.

Briefly stated, the prospects for 1926 point to a gradual development and healthy expansion in industry, which is far better than any sudden rush of business.

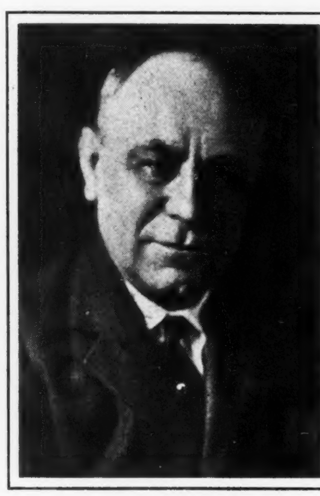
THE FIRE ENGINE INDUSTRY

By CHARLES H. FOX
President and General Manager, The Ahrens-Fox Fire Engine Co., Cincinnati, Ohio

The fire engine industry has been steadily active; it has been working at capacity for the last five years or more, and there is a slightly upward trend apparent at the present time. A condition to be deplored is the fire waste that has been mounting year by year. Statistics show that the fire losses suffered collectively throughout the country are greater now than ever before. Primarily a matter of economic importance, the enormity of the annually recurring losses by fire plainly calls for more fire fighting apparatus. The successful types of today represent an innovation that parallels the automotive industry. Builders of modern fire engines have not only contended with the difficulties confronting the automobile manufacturer, but they also have had to deal with distinctive problems of their own.

In achieving the rather recent transition from the older horse-drawn and coal-fired steamer, to the present form of self-propelling, gas-powered fire engine, the builders were obliged to pioneer extensively in research and development work; and because of excessive difficulties which are peculiar to the fire service, the lines of industry are few where "quality to endure" is so essentially associated with a factory product. Besides confirming the wisdom of recognizing specialized construction, the outcome has exposed the fallacy of adapting fire pumps—with an improvised drive—to any ordinary motor vehicle chassis. There is too much at stake to warrant false economies and inferior apparatus; and makeshifts of the sort here indicated are diminishing in public favor.

The better type of gas-powered fire engines are known to fulfill all reasonable expectations. More good apparatus is needed and could be used to advantage. More intelligent management of the highly organized modern fire engines would be productive of better results. Aside from these, however, the remedy for fewer and less costly fires falls outside the scope of anything the apparatus builder can put into his product.



Charles H. Fox, President and General Manager, The Ahrens-Fox Fire Engine Co.

FOUNDRY EQUIPMENT

By S. T. JOHNSTON
Vice-president and General Manager, S. Obermayer Co., Chicago, Ill.

There is an excessive plant capacity in the foundry equipment field, the same as in the machine tool industry; furthermore, the market for foundry equipment has not been very active for several years. At the present time, however, there is a great deal of replacement business, especially in the automobile and agricultural machinery industries, the old equipment being scrapped. The electrical industries are also quite active buyers of modern equipment, and as a whole, the business in foundry supplies and molding machines has been about 20 per cent greater in 1925 than in the preceding year. The total business for 1926 will probably somewhat exceed that of 1925. The present year must be considered normal in volume of business, although the returns to the industry have not been satisfactory.

Generally speaking, the general jobbing foundry business is not good, although the gray iron foundries, as a whole, have probably operated at about 75 to 80 per cent of capacity in 1925. In this connection it is of interest to note that the business in foundry supplies and equipment, plotted as a curve, follows almost exactly the business of the United States Steel Corporation.

The outstanding feature in this field is the elimination of hand labor and of skilled workers. This has become necessary because young intelligent men object to becoming molders. Immigration also having been practically stopped, machines must take the place of skilled labor. Many great plants today have very few molders. They have engineers who study and design devices which are operated by common labor.

Important steps have been taken along the lines of the preparation of sand and handling of sand, and sand-mixing and sand-preparing machinery is becoming an important

feature in this industry. No radical changes have been made in the equipment for melting and conveying the iron; the greatest improvements in the next year or two will be in sand preparation and molding machines, and in the development of the small utensils and equipment used in the foundry.

THE GEAR INDUSTRY

By E. J. FROST
President, American Gear Manufacturers' Association, and President, Frost Gear & Forge Co., Jackson, Mich.

There seems to be nothing fundamentally wrong with business as a whole, and the gear industry apparently is following quite closely the general trend. Competition is keen, however, and the safety of the industry demands not only a thorough knowledge of the costs of production and distribution, but a keeping abreast of the times in methods and equipment.

Obsolescence of machinery is becoming more and more a thing to be reckoned with in the realm of manufacturing, not only in relation to the quantity produced, but also to quality as well. The automobile industry has provided the quantity production and the monetary incentive for machine tool builders to produce machines for which there would have been no market ten or fifteen years ago. Electric furnaces for carburization and heat-treatment of steel owe their origin largely to the same economic pressure. Standardization and simplification have had much to do with reducing costs and at the same time improving quality.

It is not in the automobile field alone that quantity has been such a dominating factor; gasoline engines, electric motors, washing machines, carpet sweepers, row-boat motors, speed reducers, and numerous other devices lend themselves readily to the skill of the jig and tool designer, and test the ability of the creators of all manner of specialized equipment.

Materials of construction, principally steel and its various alloys, must make their contribution to the new order of things, and it behooves the steel mills to make the utmost use of their research facilities in an effort to do away with some of the troubles that have been inherent in too large a portion of their past output. Chemical analysis alone is not a satisfactory measure of the usefulness of steel for a given purpose; new standards must be evolved, and possibly methods of manufacture even radically changed, so as to produce steels free from dirt, uniform in response to carburization and heat-treatment, and capable of consistently producing under skillful handling, dependable physical properties.

To all who face unflinchingly the task of "lugging our plank" in the struggle for world progress should come, from the accomplishment of some or all of these things, not merely the right to say, during the coming year, "business is good," but that inner satisfaction that stops not at contact with mere material things, but reaches the very soul—for to endure, business must have a soul.

GLASS MAKING MACHINERY

By W. J. DONKEL
General Manager, Kent-Owens Machine Co., Toledo, Ohio

Our company, in addition to building glass-making machinery, also makes small standard machine tools and special machinery of many kinds. Owing to this diversity, the volume of our activity is affected by a number of factors. In the fields that we cover, 1924 was a much better year than 1925. Assuming the volume in 1924 as 100 per cent, the 1925 volume was about 70 per cent, and the 1926 volume is expected to be about 80 per cent. This volume evidently will not require additional plant capacity, although we are planning to replace old machines with more modern equipment to reduce costs.

The outstanding factors affecting the volume of our business in 1926, which are especially important as influencing the volume of business in glass-making machinery, are: (1) The building activity, which has been at a high rate for some years and which seems to be past its peak; (2) general business conditions; and (3) industrial developments in Europe, calling for improved machinery.

The present effort on the part of manufacturers to reduce costs because of competitive conditions will especially affect the volume of business done in standard machine tools and special machinery. Nearly all special machinery that we have built in the past has been developed to reduce costs beyond what could be obtained by existing equipment.

THE MACHINE TOOL INDUSTRY

By H. M. LUCAS
President, National Machine Tool Builders' Association, and President, The Lucas Machine Tool Co., Cleveland, Ohio

The closing of the year finds the machine tool industry in a more active condition than it has been at any time since 1920. This may not be true of every individual plant, but it certainly is true of the industry as a whole, and applies both to domestic and foreign business.

While the industry is quite active at present, this does not mean that the business is proportionately profitable, because all machine tool builders have expended a great deal during the last few years on improved designs and development work, and it is only by a continued period of activity that the expenditures thus incurred can be recuperated. The tendency to furnish an excessive amount of free service to customers is also another reason why profits are not proportionate to the volume of business. This service the machine tool builders render by pressure of competition and at a cost which it is not possible wholly to cover by the moderate prices of machine tools that prevail at the present time. Some method must be devised whereby such service as is rendered by the machine tool builder is paid for at its cost.

The maintenance of fair business practices is of the greatest importance in this industry, especially on account of the frequently recurring periods of depression, when there is always a tendency to deviate from the highest trade ethics and indulge in secret price-cutting and other unfair trade practices destructive to the industry. A high standard of business practice is absolutely necessary if the industry is to remain in a healthy condition, and only a healthy industry can serve its customers in a satisfactory manner.

The outlook for 1926 is satisfactory. It is likely that the total volume of business in the machine tool industry during the coming year will be greater than in 1925, because the coming year starts with a volume of business much larger than that handled during the greater part of 1925. Hence, the total for the coming year should show a measurable increase. Even if business remains at its present level, it would be substantially better than during the past year, and present indications all point to the likelihood that the machine tool business will not only maintain its present volume, but that there will be a still further increase.

By E. F. DU BRUL
General Manager, National Machine Tool Builders' Association

A survey of conditions leads us to believe that the machine tool industry is likely to experience a greater demand in the first six months of 1926 than at any time since the boom years of 1919 and 1920. The readjustment required after the war is now practically completed in almost all industries. Machine tool builders have been bringing out many new designs, not only of high-production machines, but of standard tools. Any one who visited the expositions held at New Haven and Cleveland last September must have seen that most of the machine tools designed ten years ago are today obsolete.

Society is constantly finding it necessary to transfer more and more skill and intelligence from men to machines. Society wants so many more things than it ever had before that the United States has not enough muscle power to produce all these things by the old-time methods. If they are to be produced at all, we have to multiply muscle and brain

power by the transfer of skill and intelligence to machinery. The demand for greater precision and productivity applies to machine tools, the same as to every other class of industrial machinery, and this demand has been met by the newer designs. In consequence, manufacturers of every kind of metal goods are coming into the machine tool market for these newer machines. They realize that it costs more to do without these machines than it does to buy them. The lower cost of production obtained with the newer types of machines puts some manufacturers at a great advantage until their laggard competitors wake up to the facts. The increased demand for goods and the restricted labor supply also make it necessary to resort to the use of more modern equipment.

It is quite natural that a good mechanic should prefer to work on a good machine that turns out accurate work, and plenty of it, with less effort on his part. Consequently, the better mechanics gravitate to the shops that have the better machines, all other things being equal. So the owner of the obsolete machine not only puts himself at the disadvantage of high costs, but also at a worse disadvantage by trying to do his work with poor mechanics as well as poor machines.

This is a hidden element in labor cost that many proprietors of obsolete equipment do not seem to realize. Those who do are very keen to purchase new machines, and it is this class that creates the present demand. As the realization of this condition has been growing with increasingly good business, the effects have been reflected in the increasing orders for up-to-date machine tools. With good general business in prospect for the first half of 1926, the machine tool builder should share in the country's prosperity. After that, only a prophet can say what is likely to happen.

N. W. Foster, Vice-president and General Manager, National Acme Co.

By W. A. VIALL
Vice-president, Brown & Sharpe Mfg. Co., Providence, R. I.

One of the outstanding factors that has impressed itself upon those interested in machine tool sales is the distribution of machinery sales over a variety of industries. These sales have been due in many cases to enlargements, but also to replacements. The most highly developed types of machines have been in demand, indicating that users are recognizing the advantages of this type of machinery when applicable to their work.

With the reduced tax, and a more settled state of finance abroad, there should be a prospect for good business during the year, which, however, contains no promise of a boom. Booms are often transformed into boomerangs, but the present outlook for substantial business is very encouraging.

By E. P. BULLARD, Jr.
President, Bullard Machine Tool Co., Bridgeport, Conn.

The outstanding and most vital factor, in my opinion, that the machine tool user must consider during the coming year is the *competition* of the modern-tooled plant that gives every aid to skilled and unskilled labor in producing quality and quantity output; and, through the means of such up-to-date equipment, allows the user to contend favorably with the price problem in marketing quality and quantity output.

The pace that is being set by *competition* in every field of endeavor necessarily demands that the user of machine tools give sincere consideration and careful study to the advantages of modern machinery, as well as to the obsolescence of "burdensome" equipment.

By FRED A. GEIER
Cincinnati Milling Machine Co., Cincinnati, Ohio

The new year opens with a very satisfactory volume of business in the machine tool industry. General business conditions may be even better in 1926 than they have been during the past year, but the machine tool demand will depend largely upon the automotive industry. The big buying in this industry during the last few months may or may not be kept up during 1926.

The export business is not in so favorable a condition as it was a year ago. During the early part of 1925 there was a very satisfactory volume of German business, but unless means are found to furnish capital to German manufacturers, the exports to that country will be curtailed in 1926. Also, unless some means are found to stabilize the franc, it is likely that the exports to France will be less in 1926 than they were in 1925. The Italian market is not much more promising; there was a large volume of business in 1925, but the largest buyer of American equipment in Italy is now well equipped.

If the machine tool industry is to be placed on a profitable basis, it is necessary that the industry as a whole reduce its costs as much as possible. Present prices permit of no profits on any other basis. This does not mean reduction of wages; nor does it mean merely reduction of labor costs; it rather means that costs must be reduced by a review of designs and materials, with a view to standardizing the product so as to permit of simplified manufacture.

By RALPH E. FLANDERS
Manager, Jones & Lamson Machine Co., Springfield, Vt.

We are hopeful of business as good in 1926 as that for 1925, or perhaps even a little better. The uncertain factor in the general situation is the possibility of inflation which some believe to be already upon us, particularly in connection with real estate developments. The old rule of a drop in business six months after a stock market decline would tend to make us skeptical of business after May, 1926. It may be that the apparently quite special reasons for this decline in stocks do not portend any drop in general business, but it will be wise for all of us to keep on the watch, and act as if it were an authentic signal of future trouble.

There is another serious unsettling factor, and that relates to the expected drop in the volume of automotive business. There is still a vast amount of machinery in automobile plants that ought to be replaced, yet it seems impossible that the large demand for automobiles can continue or that all of the firms now doing business will be able to stand the strain of competition many years longer. If this automotive business does diminish seriously, it will require with many of us an unexpectedly large increase in general business to take its place.

For the two reasons stated, we are inclined to be very cautious indeed with regard to the future, in spite of the fact that we hope for business next year as good as or even a little better than that for the year just past.

By R. K. LE BLOND
President, R. K. LeBlond Machine Tool Co., Cincinnati, Ohio

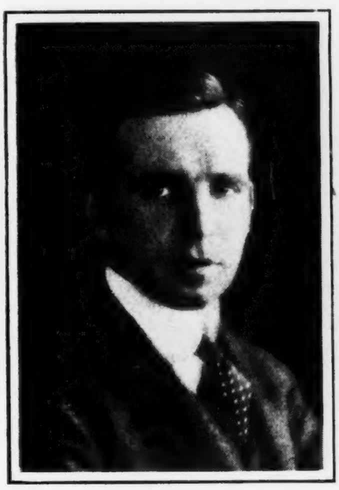
While it is true that on account of the over-capacity generally recognized in the machine tool industry, few plants are working to capacity, it must, nevertheless, be said that the volume of machine tool business at the present time is good. As general business is now about 25 per cent over its normal level, it cannot be expected that the machine tool industry will find business much better than it is now for some time to come. Hence, the prospects for 1926 are, at best, for business at about the same level as the business during the last three months.

Heavy tools have been less in demand than lighter tools, due largely to the absence of any considerable amount of railroad buying and also to the fact that the Navy is no longer in the market for heavy machine tools. The Navy shops used to be big buyers, but the present Navy program will not require any further expansion of these plants. In

fact, the Navy shops have an over-capacity, much the same as the machine tool shops.

In the small and medium sizes of machines, special rather than standard types are in demand—that is, the lathe builder must build special lathes, the milling machine builder special milling machines, etc. The automobile industry has been the best buyer, and will doubtless continue so, but will more and more insist upon machines especially adapted to individual plant requirements.

Among the facts that any observer will notice about the machine tool industry is that during the past years remarkable improvements have been made in design. In some instances, where these improvements have increased the cost of building the machines from 10 to 30 per cent, and even more, the machines are still sold at the old price. The result is that the industry is making little or no profit and will be unable to continue on that basis. An industry that, like the machine tool industry, puts its profits into improved machines, must place its prices on a basis that will permit it to pay for these improvements. Each time a new machine is designed, the jigs and fixtures made for the old model become obsolete, and an entirely new capital investment is required in a new set of tools, jigs, and fixtures. Capitalizing these is not making money, and if set up on the books, is a mistaken profit.



Edward L. Ryerson, Jr., Vice-president
Joseph T. Ryerson & Son, Inc.

The over-capacity of the machine tool industry is often referred to as a mistake in judgment on the part of machine tool builders. This is not altogether true. There are periods when the entire machine tool building capacity is in demand. The very nature of the industry requires that it should provide excess capacity to take care of peak demands; and this excess of shop capacity must be paid for in periods of less active demand by prices commensurate with the cost of maintaining a sufficient capacity for peak requirements. This has not been the case during the last five years, and the industry as a whole has made no profits since 1920, which condition cannot continue to exist.

By N. W. FOSTER
Vice-president and General Manager, National Acme Co., Cleveland, Ohio

The demand for automatic machines has increased materially in 1925, the sales of the National Acme Co. having been 75 per cent greater than in 1924. There is every likelihood of a further increase in 1926, as it has become necessary to quote six months delivery on some sizes of machines.

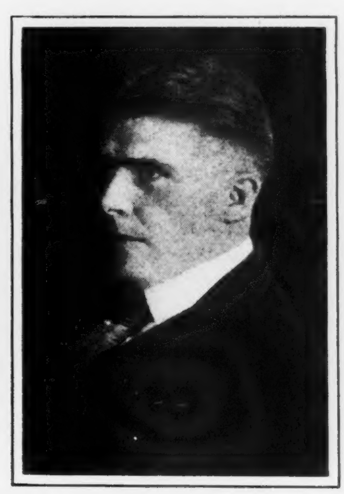
While there are comparatively few new firms starting in business at this time, the replacement business is very good. Nearly all manufacturers have concluded that the only way they can keep down costs is by using improved equipment. The constant improvements in the machines have increased the cost to the builders, but so far the increased volume in business has made it possible to maintain practically the same prices. Another method whereby the old prices have been maintained, in spite of the improvements made, has been through the elimination of some of the so-called "standard" equipment that is not necessary in the machines acquired by most buyers. Without this economy, it would have been impossible to sell the improved machines without an increase in their price.

The foreign business in National Acme machines in 1925 was three times that of 1924. It is likely that the export business next year will reach about the same volume, for, although trade with Germany has fallen off, England and France present what looks like a fairly good market for this type of machines.

By EDWARD L. RYERSON, Jr.
Vice-president, Joseph T. Ryerson & Son, Inc., Chicago, Ill.

The early part of 1925 was not very satisfactory in the machine tool industry, but during the latter months business improved considerably. On the whole, the market now averages about the same as in 1923. The prospects for the first six months of 1926 are good, inquiries are active, and at least the same volume of business ought to be done during the early months of the coming year as during the closing months of the past. Much depends upon whether or not the railroads will buy any appreciable amount of machine tools, and this is, as always, an uncertainty. During 1925 railroad buying has been rather spasmodic.

On the other hand, the machinery builder may expect a continued demand for labor-saving equipment for years to come, because present wage scales make it necessary to use machinery whenever possible. Manufacturers, however, are very careful not to over-equip, and often go without necessary equipment because of fear of over-expansion. This conservatism, sometimes excessive, is a reaction from the war conditions. When equipment is required, orders are placed at the last minute and deliveries are called for almost immediately.



Colonel F. A. Scott
President, Warner & Swasey Co.

One of the present tendencies that may prove a stumbling block to sound business practice is the extension of long terms of credit. While this practice is not prevalent in the machine tool industry, there are other lines of machinery in which it has become an important factor. Punches and shears, for example, are sold on long terms, and long credit is offered a customer as an inducement to buy. This is a dangerous practice that ought to be discouraged, and it is to be hoped that the resistance of the industry will prevent any extensive application of this principle.

By Colonel F. A. SCOTT
President, Warner & Swasey Co., Cleveland, Ohio

We are living in a metal age. We can all agree that metal is unavailable for human uses without the intervention of machine tools. Even a superficial examination of the statistics of the metal industries of the world must convince anyone that the uses of metal have advanced, and are advancing, even more rapidly than has been appreciated by those actually engaged in the production and fabrication of metals.

The expression within the iron and steel industry of our own country during the last thirty years—that the facilities of the industry were over-expanded—is entirely familiar to everyone in contact with that great productive field. Yet, during the same period the tonnage of iron ore through the Sault Sainte Marie Canal, from the Lake Superior district, increased from less than seven million to approximately sixty million tons. Within the same period the incredible development of the Birmingham district has occurred.

Do we now expect the use of metal to decrease in the years ahead of us? Are our forests increasing, and do we see a growing tendency toward the use of wood and other non-

metallic materials? Everywhere we see metal becoming the substitute for other forms of material.

However, even if the volume of metal to be worked were not to increase, the machine tool industry still would show a tremendous development by reason of the greater efficiency of machine tools, and the increased competition among metal-working manufacturers. The machine tools of today have rendered obsolete the types of ten years ago. At the same time, competition among metal-working manufacturers has been greatly intensified; therefore, it is obvious that the new types of tools will be introduced into many plants where there are far-sighted executives who realize the opportunity for greater profits through improved efficiency. This, in turn, must force the other manufacturers in similar lines to adopt corresponding methods or go out of business.

The manufacturers of automobiles, railroad equipment, plumbing supplies, electrical equipment—in fact, almost every one of the machine tool using industries of the country—are anticipating a good year in 1926. The machine tool manufacturers who are ready with their new designs at this moment, and who have shown belief in the future of their industry by being progressive during the depression, are about to reap the reward of their vision and courage.

THE METAL-CUTTING STEEL FIELD

By W. S. JONES
Vice-president, Vanadium-Alloys Steel Co., Latrobe, Pa.

On an average, it is safe to say that the tonnage of tool steel produced in 1925 has been at least 50 per cent greater than that marketed in 1924; but the sales value of the 1925 output per unit has been consistently lower than that of the previous year. Prices, in our judgment, are too low to sustain the industry permanently, in view of the continued advance in the cost of raw materials, fuel, and labor entering into the manufacture of high-grade tool steels.

The prospective demand for tool steel during the coming year appears to be satisfactory, and a large volume may be anticipated from the automotive industry, the railroads, the oil fields, the agricultural implement industries, and particularly the small tool industry. The price situation, however, is the one item that is most unsatisfactory and is growing daily more acute, because contracts for raw material entering next year's production are now being made at advances ranging in some commodities from 12 to 18 per cent above 1925 costs. The price difficulty is not one, however, that the tool steel makers alone can adjust. It is influenced to a large extent by the fact that the most extensive consumers of tool steel—the manufacturers of small tools—are reported to be selling their product on an unsatisfactory basis of return, and it would seem imperative that they readjust their sales position, along with the tool steel manufacturers, to meet the inevitable advances in the material market.

The capacity for manufacturing tool steel is still above the demand, and this, of course, has been the cause of very keen competition. The prospective demand for 1926, however, will make it possible for the industry to operate more nearly to capacity than it has for the last five years.


W. S. Jones
Vice-president, Vanadium-Alloys Steel Co.

There seems to be no cloud on the industrial horizon, provided the credit situation is kept in hand. The great amount of installment buying going on should be carefully watched, as there is a danger that it may pass the safe limit.

By CHARLES M. BROWN
President, Colonial Steel Co., Pittsburg, Pa.


Charles M. Brown
President, Colonial Steel Co.

Purchases of high-grade tool steels are steadily increasing, and some companies in this field have had a business fully 65 per cent greater in 1925 than in the preceding year. The outlook is for a steady increase in volume for at least six months to come. The automobile industry is likely to remain an important buyer, resulting in a heavy demand from the small tool industry. The great improvement that has taken place in the agricultural situation also places manufacturers of farm implements and those who supply accessories to the farm implement industry in a position to do a good volume of business for the first time since 1920. The demand from railroads has been light for the past year, but there is every likelihood of an increase of sales in this field in 1926. Every indication points to a larger volume of business during the first six months of 1926 than during the same period in 1925.

Competition is very keen in tool steels, and the tendency of prices for most grades has been downward for some time past. Prices today are generally lower than a year ago. For a long time there has been a prevailing tendency to buy for immediate delivery out of stock, the users carrying small stocks of tool steel themselves. There is danger of this tendency being carried too far. Should there be a continued increase in consumption, or should there be an indication of prices advancing, some of the larger users of tool steel would immediately stock up, and it is quite possible that the resulting withdrawals from finished stocks in the hands of steel manufacturers would result in its being impossible to fill all orders as promptly as is now generally expected.

All steels containing tungsten are likely to advance in price during 1926. The price of tungsten metal has more than doubled in the last eighteen months, and in spite of the higher prices there has been no increase in the supply. Some steel makers are still using tungsten bought at lower prices, but this supply will soon be exhausted. For a long time tungsten steels have sold at prices that do not yield a reasonable profit. In view of the higher cost of material, and in order to maintain the industry on a self-supporting basis, an increase up to 25 per cent in high-speed steel prices would be entirely reasonable.

MIXERS FOR CONCRETE—CHAIN AND CONVEYORS

By C. R. MESSINGER
President, Chain-Belt Co., Milwaukee, Wis.

The business of the Chain Belt Co. in 1925 was the largest in its history, just exceeding 1920, and ahead of that of 1924 by about 15 per cent. Inasmuch as prices were very much lower than in 1920, this means that the total volume of material produced in 1925 exceeded the previous record year by a considerable margin. The active conditions in the construction field have resulted in a particularly large business in the concrete mixer and road paver division, although both chain and conveying machinery have shown healthy increases.

We are making our plans now for a still larger business in 1926. Easy financial conditions and the prospect of lower taxes, the ability of the railroads to move promptly a large volume of commodities, and the prospect of good labor con-

C. R. Messinger
President, Chain-Belt Co.

ditions, all are factors that will help maintain the confidence which has been apparent the last few months, and which has already resulted in materially improved business conditions. The larger amount of building and other construction work which has been such an important factor in the business activity of 1925 shows no sign of abatement. Iron and steel production has gained steadily for several months. Agricultural implement manufacturers and allied industries are apparently buying more freely than for several years past, and it looks as if the farmer is on a permanently improved basis.

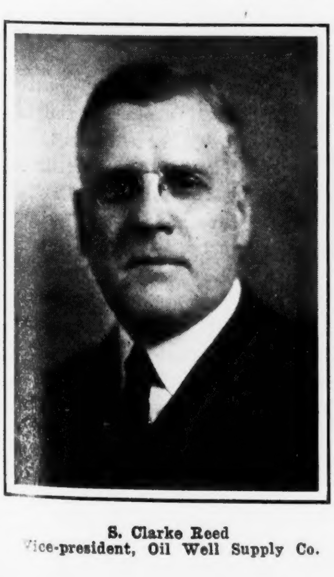
In our particular industries, the manufacturing capacity exceeds the normal demand, and operations during the present year in certain lines, especially foundries, have probably been at the rate of about 60 per cent. This has resulted in keen competition, but keen competition is a great stimulus to lower costs, and has taught manufacturers that if they are to meet present-day conditions and still show a profit, their obsolete machinery must be gradually replaced by the most modern equipment. Restriction of immigration has produced a shortage of labor which makes it imperative for the successful manufacturer to give careful study to labor-saving machinery. Common labor formerly came largely from the immigrant class, and as a result it is particularly hard to get men to do heavy, disagreeable work, such as handling of materials. Material handling equipment is therefore becoming absolutely necessary to successful operation in a highly competitive market. It is from this field that we expect to get a large part of our increased volume during 1926, and for several years to come.

While business is being done on an extremely low margin, the volume is good, and by efficient manufacturing and maintaining a low ratio of overhead expense, it is possible to do a very satisfactory business.

OIL-WELL EQUIPMENT

By S. CLARKE REED
Vice-president, Oil Well Supply Co., Pittsburg, Pa.

The man who attempts to make an accurate forecast of the future of the petroleum industry must inevitably do so with a mental reservation. There are so many factors entering into the problem that are incapable of control that he must realize that in attempting to foretell the future he is engaged in a very hazardous undertaking.



S. Clarke Reed
Vice-president, Oil Well Supply Co.

The whole oil business is fundamentally based on the production of crude oil, and it is manifestly impossible to determine, even three months hence, what this production may be. Knowing the number of coal mines in the United States, and the production of each, it is relatively easy to determine what the normal output of coal will be for any given period. The same holds true of iron ore, or pig iron, or lumber—in fact, it is true of practically every raw material; but it is not true of oil. The discovery of a new Smackover or Ranger or Drumright would, in three short months, entirely upset the industry.

In so far as the petroleum business is dependent upon and closely related to the general economic condition of the country, the outlook for the year 1926 is most promising. Fundamentally, conditions in this country are sound, credit is plentiful, labor is well employed, and the whole business structure seems to be in splendid shape.

Coming down to the factors that have a more direct bearing on the oil business, we find the automobile manufacturers, almost without exception, increasing their productive capacity for 1926 by large percentages. We find also an increasing development of state highways and a widespread movement toward the building of more and better roads. This all means, of course, an increased consumption of gasoline. On the other hand, there does not seem to be any development that might affect adversely the production of oil. The only cloud on the horizon at present is the new pool at Garber, Oklahoma, which apparently will not have any important influence on the total production for next year. Summing up all the factors entering into the problem, there seems to be good ground for the hope that the year 1926 will prove to be a profitable one for all branches of the oil business, and naturally the supply men are inclined to share in this optimistic view.

General O. H. Falk
President, Allis-Chalmers Mfg. Co.,
Milwaukee, Wis.

POWER PLANT EQUIPMENT AND HEAVY MACHINERY

By General O. H. FALK
President, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

In the lines manufactured by the Allis-Chalmers Mfg. Co., the output has been, on an average, from 10 to 15 per cent greater during the year just ended than it was in 1924. If the volume of business in 1926 equals that of 1925, it will be satisfactory, but we hope for a still greater volume. The demand for power plant equipment has been good during the past year, and every indication is that it will be equally good in 1926. The demand for large generating equipment is one of the outstanding facts in this field. The Allis-Chalmers Mfg. Co. has recently sold a steam turbine unit of 50,000 kilowatts capacity, to operate at 725 degrees F.

Among the outstanding engineering developments in this field may be mentioned the improvements in the winding of direct-current machines known as the "frog-leg" winding, which has effected a great improvement in commutation. The invention of the frog-leg winding has received the recognition of engineers throughout the United States, and there have been placed in operation, and the company has on order, over 100,000 kilowatts capacity in motor-generators and synchronous converters employing this new and advanced construction.

In regard to other lines of equipment built, it may be mentioned that the demand for crushing and cement machinery has been particularly active, while the saw mill, flour mill, and pumping engine fields have shown less activity. A new line of high-efficiency centrifugal pump has been brought out, which has attracted the favorable attention of engineers in this field.

THE PRINTING PRESS INDUSTRY

By JAMES E. BENNETT
President, Babcock Printing Press Mfg. Co., New London, Conn.

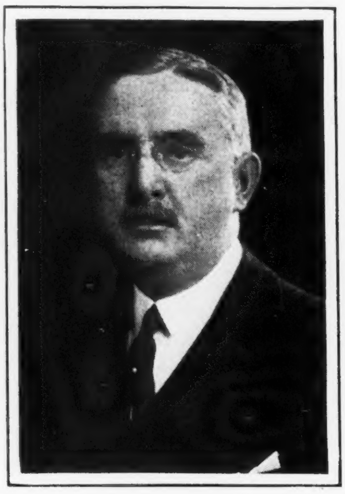
There are no unusual tendencies in the printing industry at the present time, although ever since 1919 there have been extensive gradual changes made in the printing business, due to the greatly increased demand for printed matter and the development of special machinery. In the printing press business, the increase in volume is due, on one hand, to an improvement in general business conditions, and, on the other, to the new and greatly improved equipment that has been developed during the previous dull period.

In our own case, the volume of business for 1925 will be approximately 12 per cent larger than in 1924, and we expect in 1926 a volume that will be about 30 per cent greater than in 1924. This will not require additional plant capacity, however, although some new machinery will be installed in the usual course of improving plant equipment.

ROLLING MILL MACHINERY

By J. RAMSEY SPEER
President, Mackintosh-Hemphill Co., Pittsburg, Pa.

During 1925, a number of old mills have been replaced by modern equipment, and the total volume of business in the rolling mill machinery field has thereby been increased. For several years this branch of the industry has suffered from a serious depression, and from 1921 to 1924 the amount of business was considerably below what would be termed "normal." Last year there was a noticeable improvement, due to the consistent effort on the part of steel manufacturers to diversify their product and to modernize and cheapen their methods of production. There is a drive for the elimination of man-power and the substitution of mechanical equipment.



J. Ramsey Speer
President, Mackintosh-Hemphill Co.

The prospects for 1926 are satisfactory as far as volume of business is concerned. Many of the mills in operation are still relatively inefficient, as compared with the best modern equipment available, and hence there is still, in many instances, an opportunity for reducing costs that steel manufacturers are not overlooking. The present volume of inquiries indicates that many manufacturers are alive to this situation.

Briefly, the general situation in the United States and the improvement in industrial conditions in Europe augur well for 1926. During the past year the rolling mill equipment industry has probably operated to only 60 to 70 per cent of its capacity, but the outlook now is toward a greater percentage of capacity being employed. Generally speaking, business looks so sound and stabilized at home, and is so materially improved abroad, that one has every right to expect stabilized business conditions for a number of years.

Capital, in a number of instances, has been working industriously for labor during the last few years, and has received for itself but a small compensation—in fact, it has been known to take some long chances in order to keep its forces employed as much as possible, and has not asked labor to sacrifice any of its advantages in remunerative wages. It would therefore be reasonable to assume that labor would have a very cordial feeling toward capital and would continue to be as helpful as possible in cooperating to secure a continued period of prosperity in industry. The conditions of labor and wages are, at the present time, in a stabilized state. In some fields wages may seem high, but it must be remembered that labor is a big buyer of the products of industry, and that high efficiency is more important than the matter of dollars and cents of wages.

There is a tendency toward consolidations of similar businesses in the metal-working field, some of which may take place in 1926.

As a word of warning, it should be said that it would be a serious mistake to disturb the buying impetus at the present time by too rapidly advancing prices as the volume of business grows larger. Such a procedure is really the only danger to a continued period of prosperity.

By A. F. COOKE
Vice-president and General Manager, Fawcus Machine Co., Pittsburg, Pa.

The outstanding factor in the rolling mill machinery and gearing fields is the keen competition that has characterized 1925. Wherever the plants have not been unduly expanded, the volume of business in 1925 has been satisfactory. The prospects for 1926 indicate a volume of business about equal to that of the year just ended.

It should be noted, however, that the profits in 1925 have not been in proportion to the volume of business, but have been far below what any business would call reasonable. If prices continue on the same level in 1926, the volume may be even greater than it has been during the past year, because the lower prices would encourage buying; but it will not be a satisfactory business, even for the plants that run at capacity.

The great difficulty in this field is that manufacturers do not figure their costs properly. Much business has been taken in this field at cost, and in several instances below cost. Some cast-steel rolling mill machinery has been sold at a price as low as 4 1/2 cents per pound, finished. This price can best be characterized as "impossible," because steel castings alone—the principal item of cost—cannot be obtained at less than that price per pound.

In the gear-cutting industry also, business is frequently taken below cost. Cases are on record where estimates have varied from 20 to 100 per cent of the figure that a manufacturer who knows his costs would consider the proper bid. Such extreme variations show lack of understanding of the prime cost factors. The most important thing in the gear industry for 1926 is for manufacturers to learn how to determine their costs accurately, and base their prices on the true cost, with a reasonable profit. The unsatisfactory conditions are partly due to the fact that the capacity of many plants is greater than is required by any normal amount of business. This is a condition, of course, that only time and a growing industrial development can remedy.

RUBBER MACHINERY

By F. C. VANDERGRIFT
Secretary and General Manager, Williams Foundry & Machine Co., Akron, Ohio

The one factor that will affect business in 1926 in the rubber machinery field, beyond all other things, is the abnormal price of crude rubber. I believe that this will materially decrease the sales of machinery to tire factories, but, on the other hand, there is a great likelihood that it will increase the sales of equipment for the repair of tires. Taking it all in all, therefore, one may be rather optimistic as to the outlook for 1926.

The volume of business for 1925 in our own case was 35 per cent greater than in 1924. We believe that the rubber machinery field as a whole will be fortunate if it realizes a 15 per cent increase in 1926. The fact that most of the tire factories now have all the equipment necessary for producing balloon tires, together with the high price of crude rubber previously referred to, which confines tire sales to actual necessity, leads us to believe that the mechanical equipment demand for the rubber industry will not show a very great increase.

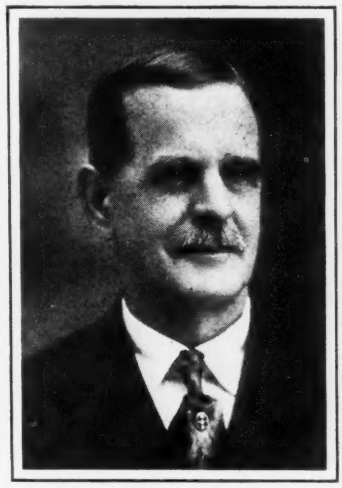
THE SCREW PRODUCTS INDUSTRY

By N. W. FOSTER
Vice-president and General Manager, National Acme Co., Cleveland, Ohio

The screw products industry has been running quite evenly since last May. The total business for 1925 will be about 25 per cent greater than in 1924. The volume for the coming year will be about the same as for 1925. The even volume has been largely due to the small inventories kept by customers, and to the tendency in the case of large orders and contracts to specify delivery or "release" dates which are not subject to cancellation. The industry is operating nearly to capacity, and while not extending its capacity, it is very active in replacing old equipment by new machinery.

Competition is keen, and there is every likelihood that it will remain equally keen during 1926. Prices, for this reason, have not advanced, and the only way a manufacturer can make his business profitable is by a reduction of costs through improved machinery and methods.

An interesting feature in this industry is the increasing tendency toward the use of brass as compared with steel for screw products. Of the tonnage manufactured, brass now represents 10 per cent.



A. F. Cooke
Vice-president and General Manager, Fawcus Machine Co.

SEWING MACHINE FIELD

By A. S. RODGERS
President, White Sewing Machine Co., Cleveland, Ohio

In general, there has been a healthy development of the sewing machine industry in 1925, the White Sewing Machine Co. having done 60 per cent more business this year than in 1924. A reasonable increase is looked for during 1926, and while all the plants in this field may not run to capacity, the leaders doubtless will.

One of the main features in the sewing machine business during the past year has been the increased use of the electric drive, which has materially stimulated sales. This will doubtless remain the main feature of the sewing machine business in 1926 and for years to follow. Eventually, we believe that this will be the only type of sewing machine sold, except, of course, in those parts of the country where no electricity is available. Along with the use of electrically driven sewing machines come increased demands for service to the user. The White Sewing Machine Co. is planning to meet this demand by special new service developments. The price of the machines must include a legitimate margin for effectively rendering this service.

In the sale of high-grade sewing machines, no recognition should be given to price competition. The cost of production and distribution must be carefully recorded, and prices based on cost and on a reasonable return on the capital invested. As mentioned, service costs must also be provided for in the price. Service and quality may be termed the prime factors in fixing prices in this industry.

Much publicity is being given to the growing tendency of installment or deferred payment merchandising. The White Sewing Machine Co. is in full agreement with the general idea that too much selling on the deferred payment plan is not a good thing economically, as far as luxuries are concerned, but in the buying of useful things and household necessities, the deferred payment plan is highly desirable. A sewing machine, for example, earns its way as soon as it enters the home. It is a "capital account" expenditure. The national economy in the use of sewing machines was even recognized by the government during the war, the sewing machine industry being counted as a necessary industry and accorded priority rights.

Electrically driven machines of all kinds have played an important part in the development of the high standard of living in the United States, and the electric sewing machine will take a prominent place among these electrically driven devices. There will be an increasing tendency toward the use of sewing machines in homes now that the drudgery of sewing is removed by the electric drive. For that reason, the sewing machine industry can look forward to a very active period during 1926 and following years.

THE SMALL TOOL INDUSTRY

By W. H. EAGER
President, Whitman & Barnes Mfg. Co., Akron, Ohio

The conditions in the small tool industry—particularly in the twist drill and reamer field, in which we are immediately interested—are more satisfactory at present than they have been at any time since the war; but manufacturers are not operating to full capacity and it will probably be some time before that condition is realized.

In saying that conditions are better, therefore, reference is made to the manner in which business is being done, to the relations of manufacturers to distributors and consumers, and to the very much better business ethics of today. There is more regard for the interests of others. A better understanding prevails among competitors in the industry, and better relations exist between distributors and manufacturers, and between consumers and distributors.

The question of surplus stocks is gradually fading from the picture, and the matter of returned goods is getting to be far less serious than it was a few years ago.

The principal thing yet to be done in this industry is to bring about standardization and the elimination of many of the types, sizes, and varieties of tools manufactured. There is untold waste in the infinite variety of products that is demanded; this waste has to be borne not alone by the industry, but by its distributors, and particularly by its consumers. It should not be understood that the consumer is altogether at fault, because manufacturers have not done nearly so much as they could and should in bringing to the attention of the consumers how this enormous expense affects their interests adversely and how it would be possible to save it, but we feel that too little thought is being given by consumers of our product to the fact that when their demands necessitate exceptional cost to the manufacturer, they themselves must bear a large proportion of that cost.

We believe that the number of types and sizes of tools now manufactured could be cut in two with very little hardship to the consumer. Prices could be reduced in this way, and the saving to the consumer would be very great. The difficulty is that there are comparatively few users of small tools who seriously consider their tool cost, and distribute it over their product. Special tools are often used, when, by very little effort, consumers could change their specifications so as to use standard tools without affecting in the least the efficency of their product. This would effect a material reduction in their tool costs.

VALVES AND FITTINGS

By JOHN B. BERRYMAN
First Vice-president, Crane Co., Chicago, Ill.

In our business (valves and fittings and kindred lines), the volume of output in 1925 has been at least 10 per cent over that in 1924. Much depends in this industry upon the continuation of building activity. The prospects are good for activity in the building field in 1926, which means continued good business in the valves and fittings industry as well.

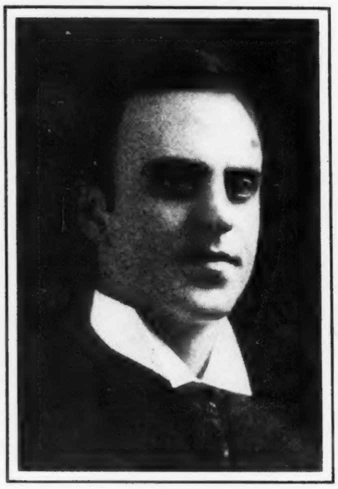
In the power plant field, the demand for the products of this industry in 1925 has been about the same as in 1924, and it is expected that business during the coming year will be

approximately equal to that of the two preceding ones. Generally speaking, if the volume of business next year is as large as during the year just past, it will be considered a satisfactory volume.

On the other hand, the commercial aspects of this industry are not so satisfactory as the volume would indicate. In spite of the very good volume of business and the increased demand in many lines, competition has never been as keen as it is now, nor the margin of profit so small. There is no good reason why this should be so, because it has been possible for most manufacturers in this industry during 1925 to operate their shops steadily, with a small labor turnover. The only solution seems to be to increase operating efficiency and thereby reduce production costs to a still lower level than they have yet attained.

By DAVID C. JONES
Vice-president and General Manager, The Lunkenheimer Co., Cincinnati, Ohio

Like most industries, the valves and fittings industry has passed through a reconstruction period which has involved several ups and downs during the last seven years. Since last July, business in this field has shown a gradual improvement, the volume increasing consistently month by month. The results for the year 1925 will be somewhat better than for 1924. Prospects are still brighter for a continued improvement in 1926. In addition to the generally improved conditions in the domestic market, the foreign markets are becoming more stabilized, and as the European problems are gradually solved and adjusted, there is no doubt that a better foreign market will be found for the absorption of a fair percentage of the production in this field.


Clifford P. Egan
President, J. A. Fay & Egan Co.

Among the new developments in this industry are valves and fittings to handle high pressures and temperatures in power plants. During the past year great strides have been made in this direction. The problem of providing the proper equipment to handle the higher pressures and temperatures has been one that has not been easy of solution, and this has made it necessary to introduce not only new designs but also new materials in the form of cast and forged steels and other materials. The power plant program for 1926, especially among the public utilities, is very large and promises a good field for the manufacturers in this industry, provided they are prepared to supply equipment of proper design and materials to meet the severe working conditions.

By HOWARD COONLEY
President, Walworth Co., Boston, Mass.

Our volume of business in 1925 shows an increase of approximately 10 per cent over that of 1924. Taking 1924 as 100 per cent, we expect 1926 to show an increase of approximately 18 per cent. The foregoing would be misleading without a brief explanation. The increase in 1925 over 1924 would be considerably larger if the price level had changed, as expected, in 1925. The 10 per cent increase represents an increase in volume as measured in terms of tonnage only, because there was so little betterment of prices that our dollar value increase did not materialize as an important factor. The increasing volume of demand usually is matched by increasing prices, and a rise in prices reflects, of course, a better showing in dollar volume.

We feel that the momentum we have gained in 1925 should carry us forward until that time when rising costs and a narrowing profit margin forces curtailment in general business optimism. We expect that this will occur late in 1926, but the first half of the year should show a very satisfactory volume of business.

The additional business which we expect in 1926 will not require additional plant capacity. We have recently acquired a large plant, but in our estimate of 18 per cent increase over the 1924 level we are not including the additional business that will accrue by reason of this acquisition.

The outstanding factors affecting the volume of business in 1926 include not only the momentum already attained, but a general economic situation that always precedes business activity. The money market is satisfactory, and there is no reason now to believe that business activity will be handicapped by any drastic credit contraction. Moreover, business is in a more optimistic state than it has been for some time, and both manufacturers and distributors are encouraged to go ahead. The only unusual tendency in our field is the increasing volume which is in evidence, but which is not accompanied by the normal increase in prices. In figuring upon an 18 per cent increase over the 1924 level, we are anticipating 14 per cent rise in volume, as measured by tonnage, and 4 per cent in price gains. Under normal conditions, the percentage of increase in prices would be larger. We believe firmly, however, that the present situation is sound, and that in the long run business as a whole will profit rather than lose by the conservative state of affairs that now exists in most industrial fields.

WASHING MACHINES

By F. L. MAYTAG
Chairman, The Maytag Co., Newton, Iowa

In the washing machine business a substantial increase in volume of output has taken place during the past year, and a similar increase may be expected during 1926. The increase in business in 1925 in the case of the Maytag Co. has been from 90 to 100 per cent over 1924. A material increase is expected in 1926—at the very lowest estimate, 50 per cent. Our factory capacity has already been increased to permit of a 100 per cent increase in output over 1925. The outstanding factors producing results in the washing machine field are the merits of the product, the ability of the selling organization, and a favorable outlook in the general business conditions. On this basis, 1926 is promising.

THE WOODWORKING MACHINERY INDUSTRY

By CLIFFORD P. EGAN
President, J. A. Fay & Egan Co., Cincinnati, Ohio

The volume of output of woodworking machinery has been approximately 10 per cent greater in 1925 than it was in 1924, and there is every reason to believe that the volume in 1926 will exceed that of the year just ended. The first six months of 1925 were not very active, but the business during the latter six months made a good average showing. If the business in 1926 continues on an even basis throughout, there should be a material increase in volume.

The design of woodworking machinery has practically been revolutionized in the last three years. At the present time, practically all machines are provided with ball bearings and with built-in motors, so that the machine is completely self-contained and all intermediate driving mediums are eliminated. The motorization of woodworking machines has been the biggest factor in increasing the volume of sales. A woodworking plant that attempts to continue to use old equipment is unable to compete with plants provided with efficient modern types, and hence, there is a big replacement business ahead in the woodworking machinery industry. Where installation of modern equipment is delayed, a competitor will get the lead and will benefit by the savings effected.

It is not an exaggeration to say that the improvements that have been made in woodworking machines during the

last three years are as great as the total improvements that had been made in twenty-five years previously. The effect on the entire woodworking industry is very pronounced. The keen competition and phenomenal growth of the automobile industry demanded quantity production, and the woodworking machinery builder is meeting the call for machines to fulfill the schedule of the production manager, who is determined to have speed and still more speed.

The advantages gained in woodworking plants by the new equipment are that belts are eliminated; less floor space is required; guarding of belts, pulleys, and countershafts becomes unnecessary; and higher speeds and greater feeds are possible because of the reduced vibration.

In the woodworking machinery industry, indications are that the plants will run practically to capacity during the coming year.

* * *

PROGRESS IN MACHINE SHOP PRACTICE

At the recent annual meeting of the American Society of Mechanical Engineers, the Machine Shop Practice Division, of which W. F. Dixon, works manager of the Singer Mfg. Co., is chairman, presented a report dealing with progress in machine shop practice; in this report it was pointed out that the progress in improving machine shop facilities during the last few years has been largely a matter of the orderly development of known principles rather than the discovery of new ones. There are, nevertheless, exceptions which will be noted. The general tendency has been, quite properly, toward relieving the operator more and more of the burden of tedious hand labor. As new machine tools are substituted for older ones, the operator usually finds that more power and more of his employer's capital have been placed under his control, and that this condition has been accompanied by the capacity for doing more and better work. Who can say that this calls for less ability or responsibility on his part?

Trends in Drives, Controls, and Operation of Machines

To this end, machine shop machinery is being made stronger and heavier, and more power is being applied to it. Direct electric-motor drive for machines is coming into greater use, partly as a result of applying more power to the machines and partly because of its facility of control. To a great extent, however, individual motor drive is popular, in spite of its more costly installation, because it makes possible a cleaner and lighter shop, eliminates overhead works, and permits the placing of machinery to greater advantage. Motor drive is being further developed into unit drive. Several motors are often applied to one machine, as this eliminates complicated gear trains and in some cases helps toward more economical construction. Sometimes the base of the machine encloses the motor.

Lubrication is receiving more and more consideration. Pressure and splash feed to all bearings and gears, with filters on the return, are becoming common. The necessity for improved lubrication increases as machinery becomes more complicated, more power is applied, and greater accuracy and longer life are demanded. Some of the latter reasons have turned many machine builders to the use of ball and roller bearings, which are installed quite as often to insure uninterrupted service and freedom from lubrication ills as to save power.

Machine control is another factor that is claiming its share of attention. Hand-cranking of tables, carriages, and slides is being replaced by fast feed movements, controlled by handy levers or push-buttons, which save both the time and energy of the operator. Many other labor-conserving devices, such as chucks and clamps, operated mechanically, hydraulically, electrically, or by compressed air, are rapidly superseding those manually operated.

Entire rooms occupied by machines working on cast iron are served by dust-collecting systems, which clear and change the air, keep the floors clean, and minimize the necessitv for brushing fixtures. Increasing attention is being given to the elimination of accidents by guarding dangerous mechanisms, and specially trained men are being employed to look for and correct hazardous machines and practices. All-geared heads and single-pulley drives, for example, increase the operator's safety. Hopper and magazine feeds are becoming common on high-production machines for light and medium-weight parts.

The iron foundry is coming more and more to use machinery. Conveyor systems, mechanical sand cutters, sand slingers, mechanical transportation of molten iron, and centrifugal casting of pipe are examples of advanced practice in this field. Some progress is also being made in the development of long-life molds.

Developments in Design of Basic Machines

In the design of lathes, mention might be made of one huge turning machine recently built which swings 300,000 pounds between centers and has eight electric motors and a 36-inch grinding machine built on a carriage for use anywhere along its 45 feet of working length. Other new lathes include automatic features, multiple-feed slides, and single-pulley drives, and on at least one of these machines the work is fed automatically from a magazine. Planing machines are being provided with power fast traverse, faster cutting and return speeds, and better lubrication. Milling machines now have stiffer over-arms, fast power table feeds, and motors inside the column. The special and manufacturing types have been developed to do a wide variety of work; in some cases they compete with the planer in the job shop, while in others they operate continuously on quantity production. The development of these manufacturing millers has been of prime importance to some of our industries.

For drilling, we have more rigid machines, higher speed machines, and more sensitive machines. Multiple-spindle drills (both standard and special) are being built for larger production. If quantities warrant, it is usually possible to secure a machine, made up of semi-standard units, to drill all the holes in a part from almost any direction.

The Important Trends in Grinding and Lapping

Grinding as a shop process has been developed remarkably during the last few years. One of the newest and most outstanding of these developments is the centerless grinder. The unusual production and precision possible with this type of grinding machine have opened up wide fields for its use. Improvements on internal grinders extend from an attachment on a universal grinding machine to an almost automatic machine which is self-gaging, self-dressing, and self-feeding. Cylindrical grinders are being made with better bearings, better lubrication, and greater ease of control. Some auto-loading machines have been built for special production. Wide-wheel straight-in grinding has come into favor on some varieties of work. Extremely powerful and accurate surface grinders are now being built. One of these has a 100-horsepower drive, while another has an automatic sizing device and is arranged to finish the work in one pass under the wheel. The grinding of threads on taps, gages, hobs, etc., has been a development of recent years, and some progress has been made in the grinding of gears. Disk grinding, which has been developed to a high state of perfection, is an important operation in many industries.

Mechanical lapping has filled a need for greater precision and better finish, and machines have been developed to lap both flat and cylindrical parts with great accuracy and high finish. It is possible by this method to produce work economically which is accurate to fractions of a ten-thousandth part of an inch.

Development of Special Machines Has Been Significant

Besides the general classes of machines mentioned, an endless variety of more or less special machines for centering, tapping, milling, threading, polishing, buffing, stamping, etc., is being produced. The greatly increased use of pressed metal, which calls for better and larger presses, has led to the recent development of machines that duplicate auto-

matically blanking and forming dies, iron patterns, molds, and engraved work.

To facilitate jig and fixture work, there are now available precision boring machines which take the guessing out of this line of work and effect a great saving in cost. The use of automatic machinery has extended to the heat-treating shop, where various mechanical devices make this phase of manufacture more accurate and economical, and more pleasant for those engaged in it. There have been accomplishments in the fields of standardization and research that would fill many pages if elaborated upon.

One of the most important developments has been that of precision measuring. Some time ago we passed from the caliper to the micrometer. Now we are passing from the micrometer to the precision gage-block, the sensitive comparator, and light interference as bases for close measurements in the shop. These accurate instruments and tools have gone far toward making real interchangeable manufacture possible at a low cost. With the increasing demand for closer limits in shop work, it is indeed fortunate that a standard of measurement can be referred to which is many times more accurate than is actually required.

Along with the mechanical progress made in machine shop practice, there has been a corresponding improvement in human relations in the shop. Lighting, ventilation, cleanliness, and safety are planned into modern shop construction. Hospitals are installed to care for those injured and, in addition, to guard the general health of workers. Schools and apprenticeship systems have been highly developed to educate the coming generation.

* * *

DISK GRINDING IN ELECTRIC RAILWAY SHOPS

The electric railway repair shops form an important and necessary part of the transportation system of the country. In many of these shops, not only is repair work handled, but new cars are built, and the machine tool equipment found in such plants equals that of any modern manufacturing establishment.

The accompanying illustrations show some examples of disk grinding work done in one of these shops. Fig. 1 shows a Gardner disk grinder in the West End Shops of the Chicago Surface Lines, Chicago, Ill. The work handled on this machine consists of bronze motor axle bearings for railway cars, 9 inches long, 6 3/8 inches outside diameter, with a 5-inch bore and an 8-inch diameter flange. Fifty half-bearings are surfaced per hour. Similar work is also done with approximately the same output at the shop of the Milwaukee Railway Electric & Light Co., Milwaukee, Wis.

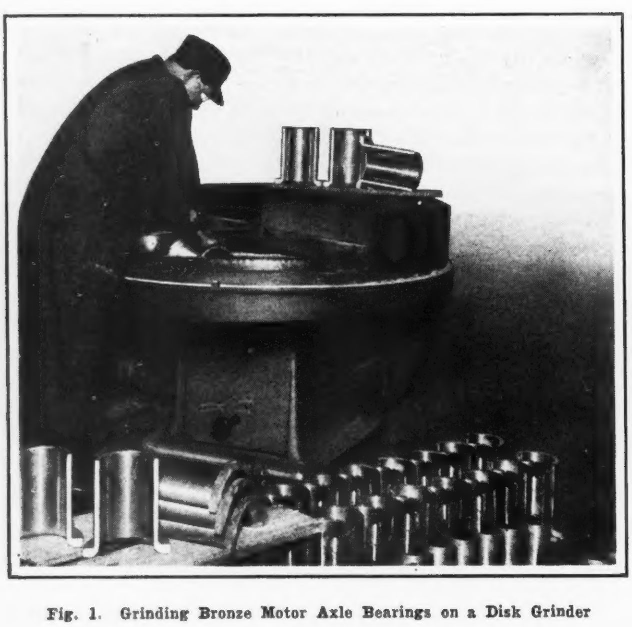


Fig. 1. Grinding Bronze Motor Axle Bearings on a Disk Grinder

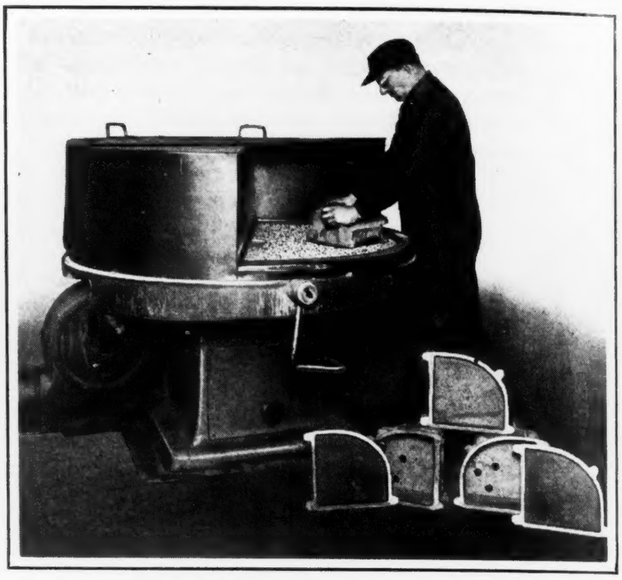


Fig. 2. Grinding Cast-iron Junction Box and Cover

Fig. 2 shows another surfacing job handled in the shops of the Chicago Surface Lines. The part shown being surface-ground is a cast-iron junction box. The covers for these boxes are also ground. The stock is removed to a depth of approximately 1/16 inch, and a production of forty pieces per hour is attained. It is stated that a marked reduction in cost has been obtained by finishing the surfaces by disk grinding as compared with former machining methods.

* * *

CALLING ATTENTION TO THE NEED FOR ACCIDENT PREVENTION

One of the impressive occasions in connection with the annual meeting of the American Society of Mechanical Engineers, held early in December in New York City, was the observance of a minute of silence in memory of the 80,000 men and women who lost their lives last year in the United States due to preventable accidents. In four of the technical sessions this silent memorial was observed, in some of them the audience standing in silence for the full period of sixty seconds. The statement read by the chairmen of these sessions was as follows:

"The accident situation in this country has reached appalling proportions, taking an annual toll of approximately 80,000 lives, while disabling over 2,000,000 more for varying periods. This yearly loss is greater than that sustained by our armies during the entire period of the World War, and has become still more serious in several of its aspects.

"Compared with other nations, there are killed in peaceful America per million of population almost twice as many as in France or Japan, more than twice as many as in Great Britain, and four times as many as in Denmark. The direct loss has been estimated to run each year into billions of dollars, while the indirect loss is beyond calculation, and our country is now confronted with a problem, already sufficiently grave, which may ultimately prove to be the greatest in its history.

"Additional to and dwarfing all such losses, however, are the human suffering and misery engendered, the extent of which none can either measure or conceive, but which must exert an increasingly retarding effect on the advancement and uplift of our country and leave a stain that can never be effaced.

"The members of this society, therefore, in recognition of the situation, which calls for the best efforts of every citizen having the welfare of our country at heart, pledge themselves and this society to continued and unremitting effort in this greatest of all human endeavor—the work of accident prevention."

The Business Outlook in the Machinery Field

Summary of the Opinions of Chief Executives in All Branches of the Industry

NO BUSINESS can be successfully managed without a plan, and a plan presupposes an estimate of the business conditions of the future; to forecast these, is not an easy matter, and even those who have made it their business to study carefully past and present conditions and to foretell the future on the basis of their conclusions often make wrong guesses. Nevertheless, every executive responsible for the successful management of a business must form a definite opinion of the future in his own mind. It may be assumed that a summary of these opinions forms as accurate an indication of what may be expected during the coming year as could be obtained by any other means.

In order to obtain the consensus of opinion, MACHINERY has asked more than 1600 responsible executives in every branch of the machine-building and machine-using industries for their opinions as to business conditions in 1926, based upon their own plans. The investigation has covered a very broad field and includes accounting and writing machines; agricultural machinery and implements; airplanes; automobiles, motor trucks, tractors, and accessories; ball bearings; blowers; boilers; brass and copper; cameras; clocks and watches; cotton ginning machinery; cranes; cutlery; die-castings; electrical machinery and appliances; steam, gasoline, and oil engines; conveying, hoisting, excavating and road-building machinery; firearms; fire engines; forgings and castings; forging machinery; foundry equipment; furnaces; gears; glass and bottle machinery; steam and gasoline locomotives; machine tools; metal furniture and trim; mining machinery; oil-well machinery; pipe; pneumatic tools; power plant equipment; power transmission equipment; presses and pressed-metal parts; printing presses; pumps; refrigerating machinery; rolling mill equipment; railway cars; rubber machinery; safety razors; sawmill machinery; screw products; sewing machines; silverware; small tools and tooling equipment; sugar machinery; textile machinery; tool steel; industrial trucks and tractors; vacuum cleaners; valves and fittings; washing machinery; wire and nails; and woodworking machinery.

Prospects for 1926

By Julius Klein, Director, Bureau of Foreign and Domestic Commerce

During the last twelve months great progress has been made in overcoming the confusion into which the world's business was thrown as a result of the war, and both here and abroad conditions reflect rapid progress from year to year since about 1922. For the first time since the Armistice, international trade has attained pre-war volume, but American participation in that trade considerably exceeds the pre-war share. American export trade in machinery is rapidly recovering from the effects of the war, and the business prospects are very bright. In the United States, industrial activity is on a very high level; the railroads have been handling the heaviest tonnage in history; the steel industry is operating nearly at capacity; pig iron production is at a high rate; the road program and building activities call for large quantities of construction machinery; in general, industry is demanding more machinery than has been the case for some years, while manufacturers' stocks have been reduced to manageable proportions. The outlook is encouraging.

Accounting and Writing Machines

P. D. Wagoner, president of the Elliott-Fisher Co., states that the company's volume of business in accounting and writing machines was 40 per cent greater in 1925 than in 1924, and approximately a 20 per cent increase over the 1925 volume is expected in 1926. The most important factor in the business situation, according to Mr. Wagoner, is a sound, sane, and sensible federal administration. The international conditions at the present time should also make for increased prosperity.

Agricultural Machinery and Implements

The activity in the agricultural machinery and implement field has been much more satisfactory in 1925 than for several years past, and the output has been at least from 20 to 25 per cent greater during the year just ended than in 1924, and in some branches much greater. The industry is optimistic, and the outlook for 1926 is good. The effect of present prices of agricultural products will have a stimulating influence on this industry. Farm tractors, especially, are very active and show the greatest improvement for any line of machinery in this field. The outlook for tractors for 1926 is unusually good, and the greater prosperity of the farmer will be definitely reflected in the business of the coming year. The foreign trade outlook is satisfactory, but the possibilities for sales of agricultural equipment and tractors to Russia is generally believed to have been over-estimated. The best export fields appear to be France, Spain, Italy, and South America.

Owing to the fact that the purchasing power in the farming districts has increased to a point where the farmer is able to buy equipment more liberally, most manufacturers of agricultural machinery and implements look forward to an increase in production of from 20 to 25 per cent in 1926 over 1925. This will not require increased plant capacity, however, because this branch of the industry has operated far below capacity for the last five years. Another condition favorable to increased output is the fact that stocks in this field, generally, are very small.

The Airplane Industry will Grow Rapidly

The airplane industry is just about to emerge from the experimental to the commercial stage. Great progress will doubtless be made during the coming year. With the exception of one or two companies, most of the business at the present time has been done with the Government; but as the practicability of commercial aviation has been demonstrated not only in Europe, but during the past year in this country also, as indicated by the statement by William B. Stout, president of the Stout Metal Airplane Co., on page 351 of this number of MACHINERY, a great change in the entire aspect of this field is likely to take place within the next year or two.

The Automotive Industries are Optimistic

The automobile, bus, truck, and tractor industries have just finished an unusually satisfactory year. Whether passenger automobile production in 1926 will exceed the figure for 1925 is open to question, but there is little doubt that the leading manufacturers will obtain a constantly growing share of the business and will be able to increase their output. The tendency toward closed cars is marked.

The motor bus business has made enormous strides during the past year, and is headed for a large expansion which will continue for from one to three years to come. The present palatial motor buses appeal strongly to the public and have proved very successful in the hands of well managed operating concerns.

The motor truck business has been at least 25 per cent greater in 1925 than it was in 1924, and leading motor truck concerns look forward to the same increase in 1926 over 1925; some, in fact, expect a still greater output.

The business of the automobile parts manufacturers naturally follows that of the principal automotive branches. The business of leading parts manufacturers during the past year has been from 30 to 50 per cent over that of 1924, and they are looking forward to at least the same volume of business in 1926.

Opinions relating to the automobile industry by Alvan Macauley, president of the Packard Motor Car Co.; Walter P. Chrysler, president of the Chrysler Corporation; Edward S. Jordan, president of the Jordan Motor Car Co.; and J. R. Hall, vice-president of the Chandler Motor Car Co., will be found on pages 352 and 353 of this number of MACHINERY.

New Developments in the Ball Bearing Industry

The use of ball bearings in the industrial field outside of the automobile field has been materially extended during the past year, and ball bearing manufacturers report a greatly increased output during 1925, some as high as from 35 to 50 per cent. Present indications are that the coming year will about equal 1925 in output, provided the automobile production remains at its present level.

The tendency in the industry is toward the use of double-row bearings, and the production of these for general industrial purposes has been much heavier than in the past. The advantages claimed for the double-row bearing are its rigidity and the greater load-carrying capacity obtained without large additional space being required for the bearing. There is an increasing tendency toward closer tolerances in the outside dimensions of ball bearings, and also a tendency toward the use of higher grade materials both in balls and in races. Tests are now being carried out in this direction, and a great development along these lines may be expected in 1926. So far, only certain sizes of balls have been made from chrome-molybdenum steel, but it is possible that the use of this or similar steel will be extended to all sizes of balls and to the races. The steel used contains approximately 0.4 per cent molybdenum and 1.3 per cent chromium. A vanadium steel containing 0.2 per cent of vanadium is also being experimented with.

If a summary is made of the statements in the present article relating to different industries, it will be found that business in 1925 has averaged from 15 to 20 per cent above the business in 1924, and that, taking an average of all industries in the machine-building and metal-working fields, the expectations are that 1926 will be a banner year, with an increase in business of from 10 to 15 per cent above 1925. This does not mean that there will be a boom. Booms are not wanted, but a steady, healthy, growing business—and every indication at the present time points to that kind of business in 1926. Over-production and undue increases in prices in some industries, especially in raw materials, are looked upon as the only dangerous factors.

Blower Manufacturers Look Forward to Good Year

The volume of business in fans and blowers (other than small electric fans) reported by leading manufacturers has been either equal to the business in 1924 or approximately 15 per cent greater. These manufacturers look forward to a still bigger business in 1926, some expecting an increase of approximately 15 per cent.

Among the factors promising an increase in volume of business in this field are the following: (1) The building boom will doubtless continue for another six months at least. (2) Large industrial concerns and railroads are entering the market to a greater extent than they have at any period during the last four years. (3) There is a feeling of confidence throughout industry in the business judgment of the national administration; and this, together with sane tax legislation, will help to improve the business structure.

Boiler Makers Expect About the Same Volume of Business Next Year

In the power boiler field, the business was generally either equal to or about 10 per cent greater than in 1924. About the same volume is anticipated for 1926 as was handled in 1925. Very keen competition and low prices characterize this field. Manufacturers must equip themselves for reducing costs if they are to meet this keen competition, and only those possessing the most up-to-date equipment and the best management will be able to compete successfully. On the whole, the industry operates at only 75 per cent of its capacity; hence, what new equipment is acquired will be to replace less efficient machinery.

In the cast-iron boiler and radiator field, the volume of business has averaged around 10 per cent above 1924 in tonnage, but due to decreased prices, the dollars and cents turnover has hardly exceeded that of last year. With continued building activity, manufacturers look forward to an increase of from 5 to 10 per cent in 1926 over 1925.

The Brass and Copper Industry

In the brass and copper rolling mill field, manufacturers have experienced an increase in business of from 10 to 15 per cent in 1925. Some of the largest manufacturers expect that the volume of business in 1926 will about equal that for the year just ended. The fact that buying has been done largely to cover only immediate requirements, stocks in the consumers hands therefore being low, is considered one of the important reasons for expecting continued good business in this field.

Clocks and Watches

In the clock and watch industry, the average output, according to the information available in this survey, has been 10 per cent less in 1925 than during the preceding year, but manufacturers are now planning on an increase in the output in 1926, some making plans for as much as 20 per cent additional production.

Demand for Cotton-Ginning Machinery Has Increased

The year just closed is considered a normal year by manufacturers in the cotton-ginning machinery field. On an average, there has been a 25 per cent increase in business in 1925, and present indications are that 1926 will be equal to 1925, and possibly better. The business in this field depends, of course, upon the cotton crop. Owing to successful progress in fighting the boll weevil, the prospects are good for a large cotton crop in 1926. One of the leading manufacturers in this field is increasing his facilities and has recently started the building of a new machine shop which will permit an increase of 25 per cent in his output. One manufacturer, who doubtless has been able to obtain more than his share of the business, trebled his output in 1925 as compared with the previous year, and expects to increase this by 25 per cent in 1926.

The Crane Industry is Gradually Gaining

In the crane industry, few, if any, plants have worked to full capacity for several years past. Some of the largest plants averaged 50 per cent or less of their plant capacity in 1924 and about two-thirds of their capacity in 1925. There has, however, been a steady increase in business during the past year, and present indications are that 75 per cent of the crane-building capacity will be operated in 1926. The outstanding factor in this field is the hesitancy on the part of purchasers in placing orders. Several months or even years are spent considering a proposition, and then, when

the decision is made, deliveries are wanted immediately. Hence, the industry never has a large volume of unfilled orders ahead. The competition is intensely keen, as might be expected when the industry operates so far below capacity.

A leading manufacturer states that the next two years promise to be satisfactory in the crane and allied fields. The very moderate business done in 1924 has made it possible, in some cases, to double this business in 1925, and to expect another 50 per cent increase in 1926.

The Cutlery Industry

Cutlery manufacturers report about the same volume of business in 1925 as in 1924. Where there has been an increase, it has only been about 5 per cent. If general business conditions remain as good as they are at present, an increased volume of business is expected in 1926. The more conservative estimates are from 5 to 10 per cent above 1925, while one runs as high as 40 per cent. In the latter case, the increase is expected because of special sales efforts on the part of one company. This industry is affected by the conditions in the retail hardware trade, which are a great deal better than for several years past. The tendency to buy from hand to mouth is not anywhere nearly so strong as it has been.

The cutlery industry in general is fully equipped for taking care of a greatly increased production, having had a great deal of this equipment standing idle for the last six years.

Prospects of the Electrical Industry

The larger electrical companies have experienced a better year in 1925 than in 1924, and the prospects are that business in 1926 will reach at least the same level, or possibly be even better. This is especially true in the power plant field. In the small motor field and in electrical tools and appliances generally 1925 has been from 5 to 33 per cent better than 1924, and one company expects 1926 to be the best year in its history, having been forced to increase its equipment in order to take care of a considerable volume of business booked ahead. The low stocks carried by jobbers and dealers react favorably upon the industry, and in almost every case manufacturers expect from 20 to 25 per cent bigger business in 1926 than they had in 1925, the more conservative estimates of the larger firms being from 5 to 10 per cent.

Steam, Gas and Gasoline Engines

In the steam engine field, there has been no appreciable change in the volume of business in 1925 as compared with 1924, and the present outlook indicates that there will be approximately the same volume of business in 1926. Economy in operation is pointed to by one manufacturer as the prime idea in the minds of buyers of engine equipment, and machinery that meets this requirement will be in demand. The gas engine field is characterized by much the same comment as the steam engine branch. A statement by G. A. Rentschler, president of the Hooven, Owens, Rentschler Co., relating to the engine and heavy machinery fields will be found on page 356 of this number of MACHINERY.

Some manufacturers of small and medium-sized gasoline engines have had an improved business during the year, due to the gradual return of the farmer as a buyer; on the other hand, the increasing use of electricity for power and light will make a material difference to manufacturers of gasoline engines for farm use, and some manufacturers have found it necessary to engage in additional fields. On an average, the business in 1925 has either equalled that of 1924 or been about 10 per cent greater. From 10 to 20 per per cent increase is expected in 1926. This increase in business can be taken care of without additional facilities, because there is still a large surplus of plant capacity for farm gasoline engines. In the portable gasoline engine field for construction purposes, propects are good; 1925 has run ahead of 1924, and the coming year will most likely run ahead of the one just ended.

Excavating, Conveying and Hoisting Machinery

One of the largest producers of excavating machinery states that the volume of business in 1925 exceeded that of 1924 by 15 per cent, but unfortunately earnings did not increase in the same proportion. The prospects of the steam shovel business for 1926 are especially good. The Florida boom has produced an active demand for small excavating machinery, and the exceptional demand there is likely to continue for some time to come. The activity in road-building will continue for years, and as there is no marked falling off in general building activity yet, there is every reason to look forward to a very active year. It may be expected that gradually the building activity will fall off, but this will not happen suddenly.

The foreign trade in 1925 has been better than in any year since the war; the demand for excavating machinery has come from all parts of the world, but especially from non-European countries. On the other hand, the competition on the part of European manufacturers has greatly increased. The outlook for the foreign trade for 1926 is about the same as for the past year, except that the competition abroad and possible tariff revisions in some countries will have a tendency to decrease American exports.

The reports of a large number of builders of excavating machinery indicate that the business in 1925 has been from 5 to 15 per cent greater than in 1924, and the expectations for 1926 are from 10 to 15 per cent in excess of 1925. In one instance, an improvement of from 60 to 75 per cent is expected which will require a 15 per cent additional plant capacity. One of the hopeful signs in this field is the fact that the appropriations already made for road building for 1926 are larger than for 1925.

In conveying, hoisting, and elevating machinery, the average volume of business in 1925 has equalled or exceeded that in 1924, and all manufacturers expect a still further improvement in 1926—some as much as 25 per cent. This additional volume, it is stated, did not require an increased plant capacity—only replacement of some old and worn out machines with more modern equipment. Opinions relating to the elevating, hoisting, and conveying machinery field are also given in the statements by Charles Piez, chairman, Link-Belt Co., on page 353, and by A. C. Brown, president, Brown Hoisting Machinery Co., A. T. Perkins, vice-president and general manager, Webster Mfg. Co., H. Harnischfeger, president, Harnischfeger Corporation, and H. L. Donahower, president, Standard Conveyor Co., on pages 355 and 356 of this number of MACHINERY.

The Firearms Industry

One of the leading manufacturers of firearms states that the volume of business in 1925 has been slightly in excess of that for the corresponding period in 1924, and that indications, based upon expressions of distributors, are that the volume for the first six months in 1926 will be greater than that for the same period in 1925. The conditions in this field, however, are such that no additional plant capacity will be required even for a material increase in production.

Steady Growth of the Fire Engine Industry

One of the leading fire engine companies has had a volume of business in 1925 about 10 per cent larger than that in 1924, and anticipates an additional 10 per cent increase in 1926. There are no visible factors that would adversely affect this business in 1926, provided inflation and consequent tightening of credits can be avoided. A further statement in regard to the fire engine industry, by Charles H. Fox, president and general manager, Ahrens-Fox Fire Engine Co., will be found on page 356.

Forgings and Castings

The drop-forging business has varied to a great extent according to the line of manufacture engaged in. One drop-forging plant specializing in crankshafts, camshafts, and axles for automobiles, trucks, and tractors has nearly doubled

its volume of business in 1925 and expects to do at least as much if not more business in 1926. This is an unusual case, however, depending on special conditions. Most drop-forging plants have had to be satisfied either with the same volume of business or with a moderate increase up to, say, 20 per cent in 1925, and expect no appreciable increase in 1926. On the other hand, all expect a steady business because of small inventories in the hands of manufacturers, wholesalers, and retailers; the ample supply of credit; and a political situation that is encouraging to good business for several years to come. The drop-forging industry is also dealt with in a statement by Charles E. Adams, president, Cleveland Hardware Co., on page 354 of this number of MACHINERY.

Concerns specializing in gray iron castings report from 10 to 25 per cent larger volume of business in 1925 than in 1924. Some look forward to a falling off in 1926, while others expect business to remain about the same; still others look forward to an increase of about 10 per cent. The malleable iron castings field was very quiet in 1924, several foundries have had as much as a 60 per cent increase in 1925, and are expecting an additional 15 to 20 per cent increase during the coming year. In this field, the improved purchasing power of the farmer is an important factor.

The foundry equipment field is reviewed in a statement by S. T. Johnston, vice-president and general manger, S. Obermayer Co., on page 356 of this number of MACHINERY.

Gains in the Forging Machinery Field

The year 1924 was a very quiet one with most forging machinery manufacturers, but with one exception there was a material increase in the volume of business in 1925, ranging from 40 to 75 per cent. All manufacturers expect an increase in 1926 over the year just closed, the estimates of these increases varying from 15 to 60 per cent. With this increase, some plants would run practically at capacity, others would reach about 80 per cent of capacity. The continuance of automotive production and the development of a greater demand from the railroad shops are considered among the most important business factors during the coming year. A considerable volume of export business is not expected, although there has been an improvement during the last few months in the foreign field, the export business averaging with some manufacturers from 10 to 15 per cent of total sales.

The Electric Furnace Industry

There has been a great expansion in the electric furnace industry during 1925. For the whole field, the volume of business has probably been three times that of 1924, and there is every indication that the business in 1926 will be even greater. The tendency is toward bigger furnaces with greater kilowatt capacity. A few years ago the automotive industry was the only one that was interested in large electric furnaces, but now industries in every field all over the United States are buying and installing equipment of this kind.

There is a great deal of difference in the quality of furnaces built by different makers, and prices vary accordingly. As an example it may be mentioned that for the same size of furnace, bids have varied as widely as from $1500 to $3400. Manufacturers building a high-grade furnace state that in this particular case, labor and materials alone would amount to $2000, leaving nothing for overhead, engineering, or profit. Hence they claim that it would be impossible to build a satisfactory furnace at the low price mentioned. Without doubt, much business has been taken below cost, as is indicated by the numerous failures in this business. New concerns, however, have been starting as the old have failed, but the makers of quality furnaces are remaining in the business.

The Gear Industry Faces Keen Competition

In the gear-cutting industry, 1925 has been a good year. Some gear manufacturers have had a volume of business up to 75 per cent greater than in 1924, and expect at least 25 per cent more business in 1926 than in 1925. The tendency is toward complete gear reduction units rather than separate gears. One maker of these units has business ahead for five months and finds that the general industrial field shows considerable buying activity in this direction.

The steel mills are also rehabilitating their equipment, and many of the old mills have placed orders that indicate that there is going to be a big business in this direction in 1926.

One of the leading gear manufacturers, in referring to the keen competition that has characterized 1925, said: "Competition is all right. It forces us and everybody else to adopt modern machinery and methods; it makes us reduce the waste. Anybody can stay in business if he has no competition, but competition singles out those who are willing and able to work and think."

The over-capacity in the industry is due to three factors: First, the extension of plant without due regard to normal demand; second, the use of improved machinery which makes it possible to produce the same volume of product in less floor space and with fewer men; and third, greater efficiency of labor, more carefully directed.

Steam and Gasoline Locomotives

In the steam locomotive field, the volume of business in 1925 has been much less than in 1924—only between 50 and 60 per cent of the latter year. Present indications point to an improvement in 1926, when the volume will probably again equal that of 1924. Locomotive orders in 1926 will depend largely upon the volume of traffic that the railroad companies are called upon to handle. If business as a whole remains at the level of 1925, many roads will require additional engines. An interesting development in the locomotive field is the experiments being made with the Diesel type of engine, but these developments are not likely to affect the volume of steam locomotive business during the coming year. The plant capacity for handling any expected volume of business in this field is ample.

In the gasoline locomotive field there has been an improvement of business in 1925 of from 10 to 30 per cent. Manufacturers look forward to an additional 15 to 50 per cent improvement in 1926. One of the builders of gasoline locomotives is working to capacity, and has recently placed a contract for a building to increase its plant by 50 per cent.

The Machine Tool Industry

The condition of the machine tool industry is reviewed by a number of manufacturers in this field on pages 357 to 360 of this number of MACHINERY. During the past year the volume of business has varied considerably in different shops. On an average, the business has been from 30 to 35 per cent better than in 1924. In unusual instances, the 1925 business was double that of the previous year, while in other cases it was not appreciably greater. Most manufacturers expect slightly better business in 1926, the average percentage of increase expected being about 15 per cent over 1925. Such an increase would require from 50 to 75 per cent of the capacity of machine tool plants, and in a few instances the plants would be running full force and full time.

The export trade, while it has improved considerably, still accounts for only a very small share of the total machine tool output—in most cases not more than 5 per cent, and seldom over 10 per cent. In rare instances it runs up as high as 20 or 25 per cent of the output of the plant.

Metal Furniture, Doors, and Trim

A general improvement has been experienced in the entire field of metal furniture, doors, partitions, and trim. The Dahlstrom Metallic Door Co., Jamestown, N. Y., states that business in 1925 has been approximately 15 per cent better than in 1924. Continued building activity and continued prosperity in the automobile trade will be the factors that will determine the volume of business in 1926. As there is no indication of any falling off in either of these two industries at present, the prospects are for continued prosperity.

Mining Machinery

In the coal mining machinery field, the activity in 1925 has not been so satisfactory as in many other fields. There has been very little buying of machinery for soft coal mining, and some manufacturers have had only two-thirds the volume of business in 1925 that they had in the preceding year. There is, however, evidence of an improvement at the present time, and the demand for coal mining machinery is likely to increase during the coming year, it being expected to at least reach the volume of 1924.

The demand for mining machinery other than coal mining equipment has been considerably better during the past year than it was a year ago, and the outlook for 1926 is even more satisfactory. An average improvement of 10 per cent is recorded in 1925, and it is likely that the same ratio of improvement will continue in 1926. The iron and steel industry, operating as it does at high capacity, will require more ore handling equipment. The increased price of copper is likely to bring about the demand for excavating and mining machinery in this field. There has been little demand for dredging machinery for harbor work, a class of machinery generally built by mining machinery manufacturers. This work has been more or less suspended since the war, but present indications are that there will be a change in this respect during the coming year.

Oil-well Equipment

A brief review of the situation in the oil-well equipment field is given in the statement by S. Clarke Reed, vice-president, Oil Well Supply Co., on page 361 of this number of MACHINERY. Some of the manufacturers that furnish oil-well machinery and equipment report an increase in business of 25 per cent in 1925 and expect an additional 15 per cent increase in 1926. In this industry, some plants are working nearly to capacity, and will require additional equipment. One of the factors that will affect the volume of business in this field favorably next year is the small stock in the hands of users. There was a good deal of over-stocking of drilling equipment in 1923, and this over-stocking has influenced the business adversely ever since, but the point has now been reached where these stocks are depleted, and therefore a still further improvement is expected.

The Pneumatic Tool Industry

The outstanding factors affecting the volume of business in the pneumatic tool field in 1926 are a continuation of building operations; continued activity in the automobile field; the need of new equipment by the railroads, and the consequent resumption of larger production by foundries, car shops and steel mills; and improved foreign conditions. An improvement has made itself definitely felt in 1925, and leading concerns state that their business has been from 10 to 20 per cent greater than in 1924. In 1926, a volume of business from 10 to 25 per cent greater than in 1925 is expected.

Power Transmission Appliances

In view of the improvements in practically every industrial field, it is evident that the power transmission machinery and appliance field should also share in the general improvement. Leading companies state that their business has been from 10 to 30 per cent better than in 1924. In general, approximately the same volume of business is expected in 1926. In exceptional cases, an appreciable increase is anticipated. While there is a strong buying power throughout the country, there is, nevertheless, intense competition between manufacturers of transmission equipment, because the manufacturing capacity exceeds the demand. The greatest need in this field is the stabilization of the price situation.

The Power Press Field

In the power press field, the increase in the volume of business over 1924 has been very marked, averaging about 35 per cent. Some press manufacturers expect about the same volume in 1926, some a slight decrease. In any event, they look forward to at least 10 per cent more business than in 1924. If the present prosperity in the automobile field, the manufacture of electrical equipment, and agricultural machinery and implements continues, a still larger volume of business may be expected.

The Demand for Pressed-steel Products is Growing Rapidly

Manufacturers of pressed-steel products of all kinds have generally had a good year. Those manufacturing standard articles have had a smaller increase as compared with those who have been engaged in contract work, mainly for the automobile industry. Increases of from 25 to 75 per cent over 1924 are not unusual. Approximately the same volume of business is expected in 1926, some manufacturers looking forward to a slight increase. The competition is unusually keen, especially when the products are merchandised through the automotive jobbing trade. The improved financial condition of the farmer and the continued activity in the building trades are looked upon as important factors in this field.

Printing Presses Furnish a Good Business Barometer

The printing press business is a good indicator of business conditions in other fields. It is one of the first industries to benefit when business is on the up grade, and one of the last ones to suffer from a depression. At present, the industry is quite active, although possibly not so active as in 1923. The prospects for 1926 are very encouraging. The development of high-speed jobbing presses and the remarkable growth of the offset process of printing has added to the activity in 1925, and will continue to be a factor in the business during the coming year. A general statement relating to the printing press field is given by James E. Bennett, president of the Babcock Printing Press Mfg. Co., on page 362 of this number of MACHINERY. Other manufacturers report an increased volume of from 25 to 75 per cent over 1924, only one manufacturer stating that the business in the two years was about the same. The present volume of business is generally expected to continue during 1926, at least during the early part of the year. In some instances the entire manufacturing capacity is occupied by the present output, and plans for additions are being made.

Pumps and Pumping Equipment

While the total volume of business in pumps for all purposes has been quite satisfactory during 1925, and while the prospects are still better for 1926, the business has been very "spotty" throughout the year. Leading manufacturers, although looking forward to a good year, do not expect it to be uniform throughout the year, although the industry is gradually moving toward a more balanced condition. The general tendency is toward hand-to-mouth buying, customers deferring purchases until they are immediately needed. This is also true of dealers, whose stocks, therefore, are very small.

Among the factors that will be of importance in this field during the coming year are the buying by municipalities who are installing new and larger water supplies, and the replacement of obsolete pumps by modern and more efficient pumping equipment of new or improved designs. The volume of business in 1926 will depend almost entirely on the manufacturer's ability to produce high-grade equipment at low cost.

Taking an average of the statements of different pump manufacturers, it will be found that the volume of business in 1925 was 15 per cent over that of 1924, and an additional increase of approximately 10 per cent is expected in 1926. A few manufacturers had the same business in 1925 as during the preceding year, while some had as much as 40 per cent more. The industry is uniformly optimistic for 1926.

Refrigerating Equipment

A prominent manufacturer of refrigerating equipment states that the volume of business in this field has greatly improved in 1925, in his particular case having been over 60 per cent greater than in 1924. It is expected that the

business in 1926 will be about 50 per cent greater than that in 1925. This additional volume of business will not, however, require any further plant or equipment, because sufficient capacity has been available for such an increase ever since 1918. The increase in volume in the case of this manufacturer is due largely to the general increase in business resulting from the sale of small mechanical refrigerating units.

Railway Cars

One of the leading builders of railway cars states that, basing the percentages upon the value of shipments, the business in 1925 has been 4 per cent in excess of that in 1924, and it is estimated that the business in 1926 will be about 25 per cent better than it was in 1925. At the present time there are no unusual conditions in the car building field that will be likely to have any particular effect on the volume of business during the coming year, except a general expansion of the transportation facilities as a whole.

Rolling Mill Equipment

The rolling mill equipment industry is covered by statements by J. Ramsey Speer, president, Mackintosh-Hemphill Co., and A. F. Cooke, vice-president and general manager, Fawcus Machine Co., appearing on page 362 of this number of MACHINERY. The volume of business in this field has been satisfactory during 1925, and manufacturers in general expect to receive from the large steel companies at least as much business in 1926 as during the past year.

Saw Mill Machinery

The business in saw mill machinery during 1925 has been about equal to that of 1924, and there is no reason to expect that the volume will be materially greater in 1926. While the building industry will doubtless continue at about the present rate for the better part of 1926, at least, it is not likely that it will increase in volume. It is more probable that it has passed or will soon pass its peak.

The Screw Products Industry

A general review of conditions in the screw products industry is given in the statement by N. W. Foster, vice-president and general manager, National Acme Co., on page 363 of this number of MACHINERY. Screw product manufacturers generally report an improved business in 1925—on an average, 10 per cent in excess of 1924. The business in 1926 is likely to be as good as or better than during the year just ended. This larger volume of business may not bring in any greater profits, because competition is very keen and selling prices are showing a tendency to decrease, even though the volume of business increases.

Sewing Machines

A brief statement relating to the sewing-machine industry is given by A. S. Rodgers, president, White Sewing Machine Co., on page 363 of this number of MACHINERY. Other sewing machine companies report an increase of business in 1925 averaging 20 per cent over 1924, and expect approximately the same volume of business in 1926 as during the year just closed.

Small Tools and Tooling Equipment

The average volume of business in twist drills and reamers in 1925 has been from 10 to 15 per cent greater than in 1924. Some of the leading manufacturers expect a 10 per cent increase in 1926, while others hope for at least as big a business in the coming year as during the past. Such a volume of business would occupy the plants at from 65 to 85 per cent of capacity. The export business has not been unusually good, although some manufacturers have exported about 10 per cent of their total product. The European market is difficult to enter, because European manufacturers of drills and reamers are able to quote approximately 30 per cent lower prices.

In the tap and die field, a similar improvement is noted. A 15 to 20 per cent increase in 1925 is expected to be followed by an additional 10 per cent increase in 1926. This will bring the operating percentage of capacity of most of the plants in this industry up to anywhere from 70 to 85 per cent. The export business in taps has, on the whole, been good for the last two years with those manufacturers who make a decided effort to obtain this trade, one of the leaders exporting as much as 20 per cent of his total production, while others have exported about 10 per cent.

In the tool equipment field—dies, jigs, and fixtures—1925 has been a much more satisfactory year than 1924. The increase in business with different manufacturers has varied from 15 to 70 per cent of the 1924 volume. All firms engaged in this line of business expect a still further improvement in 1926, or at least a volume of business equal to that of 1925. Some of the shops engaged in this line of business have been running to capacity for several months, and are quoting on deliveries several months ahead. The equipment built is not related to any one or a few industries, but, in general, is well distributed over the entire industrial field. As a whole, this branch of the industry is now better employed than at any time since 1920. Although prices are such as to force much work to be taken at a close margin, the tendency is toward more stabilized competitive conditions than for several years past.

Sugar Machinery

One of the builders of sugar machinery reports an increase of 25 per cent in the 1925 business and expects an additional 20 per cent increase in 1926. There is, however, ample plant capacity to take care of this increase in volume. The fact that sugar prices were very low during 1925 and have shown a tendency to increase substantially during the past weeks makes it possible for the manufacturer of sugar machinery to look forward to a fairly active business. All manufacturers of sugar machinery are not equally optimistic, one large producer stating that his 1925 business was much less than in 1924, and that a material improvement could not be expected in 1926.

Textile Machinery

In the textile machinery field, the conditions in 1925 were not very satisfactory. The outlook in the textile industry at the beginning of last year was not such as to warrant textile manufacturers to come into the market for additional plant equipment. The prospects for 1926 are much more encouraging. In spite of the difficulties in the textile industry, textile machinery manufacturers, on the whole, have maintained about the same output in 1925 as in 1924. Some have been able to do 10 per cent more business, while others have done about 10 per cent less. As regards the prospects for 1926, a 10 per cent increase over 1925 is generally looked for, one leading firm expecting to do much better than that, possibly from 25 to 33 per cent better. This, however, will not require additional plant capacity, as some of the largest manufacturers in this field are not now operating their plants at more than from 50 to 60 per cent of full-time capacity.

The textile industry has been depressed so long that it must sooner or later return to its normal cycle, and that return is now approaching. Among the favorable circumstances are cheap cotton and low-priced wool. On the other hand, the use of "rayon" and other substitutes for cotton and wool may produce a quiet condition in the cotton and woolen mills for the next year or two, even though general business remains as good as it is at present.

Industrial Trucks and Tractors

On an average, the industrial truck and tractor industry has improved its volume of business in 1925 by 15 per cent, and it is expected that another 10 or 15 per cent improvement may be looked for in 1926. Among the factors that influence the activity in this industry are the marked improvement in other branches of industry, good crops, and the

conservative buying of the past, which has prevented surplus equipment for material handling in the plants.

Vacuum Cleaners

For several years there has been a tendency in the vacuum cleaner field toward eliminating the ordinary forms of distribution, the manufacturer going directly to the consumer with his goods. This appears to have aided in stimulating the business, and taking it as a whole, the vacuum cleaner industry for 1925 is expected to run considerably ahead of 1924. That there will be a similar increase in 1926 is beyond doubt, some firms expecting from 25 to 50 per cent increase.

Valves, Pipe, and Fittings

Statements relating to the valve and fittings business by John B. Berryman, first vice-president of the Crane Co., David C. Jones, vice-president and general manager of the Lunkenheimer Co., and Howard Coonley, president, of the Walworth Co., are given on pages 363 and 364 of this number of MACHINERY. The volume of business in this field has varied considerably with different manufacturers, some having had a smaller business in 1925 than in the previous year, while others report approximately the same volume of business, and still others a substantial increase. Usually these increases are accounted for by the introduction of new developments in the field. The prospects for 1926 depend largely upon the building industry. Some manufacturers do not look forward to any larger business during 1926, while others are estimating a 20 per cent increase.

In the malleable iron fittings industry, the output in 1925 was about equal to 1924, but it showed a great increase during the latter part of the year. It is expected that the volume of business at the present time will continue throughout the better part of 1926, in which case a total improvement over the year just ended of from 15 to 20 per cent could be recorded.

Water Works Equipment

In supplies and specialties for water works, the volume of business of one of the firms in this field in 1925 was 15 per cent greater than in 1924, and approximately the same increase is expected in 1926. D. F. O'Brien, president of the A. P. Smith Mfg. Co., East Orange, N. J., points out that this increased volume of business will probably take place during the first six months of the year, as there are reasons to believe that there will be a slackening of business during the latter half of the year in this field. Fewer municipalities will be able to continue to borrow money because of the indebtedness already incurred.

Woodworking Machinery

A statement relating to the woodworking machinery industry by Clifford P. Egan, president, J. E. Fay & Egan Co., will be found on page 364 of this number of MACHINERY. On the whole, the output of woodworking machinery has been materially greater this year than last, averaging about 20 per cent. One manufacturer looks forward to an increase in business next year of from 15 to 25 per cent; it is not expected, however, that business in general in the woodworking field will improve to this extent.

Miscellaneous Branches of the Industry

A manufacturer of silverware states that the volume of business in 1925 was 10 per cent better than in the preceding year, and expects that during at least the first half of 1926 business will still further improve.

A manufacturer of cameras and moving picture apparatus states that the business in 1925 has been exceptionally good, having increased nearly 100 per cent, with prospects that 1926 will be an equally good year. The introduction of the small moving picture camera that can be sold to individuals will still further develop business in this field.

A manufacturer of machinery for bottling plants states that there has been an increase of 50 per cent in this business in 1925, and basing the estimate on orders received during the last three months, there should be a further increase of about 15 per cent over 1925 during the coming year.

In the laundry machinery business, the volume of output has been approximately 15 per cent greater during 1925 than it was in 1924. The outlook for the coming year is for a volume of business about equal to that in 1925.

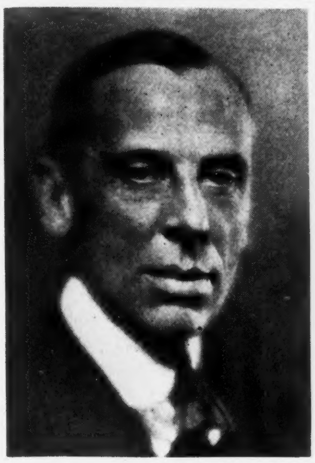
The safety razor field is constantly growing. One of the largest concerns in this branch states that business increased 20 per cent in 1925, and an increase of from 10 to 15 per cent above the year just ended is expected in 1926.

* * *

PROSPECTS IN THE AUTOMOBILE INDUSTRY*

By ALFRED P. SLOAN, Jr., President, General Motors Corporation

There is ample reason to expect that the first half of 1926 will be a period of general prosperity, and the automobile industry should share in this prosperity. The latter half of 1926 is still too far away for one to judge with much assurance what it may hold in store. I shall, therefore, limit the expression of my view regarding the outlook to the next six months.



Alfred P. Sloan, Jr.
President, General Motors Corporation

The momentum of the business recovery since last summer will tend to keep business active during at least the first half of 1926. Conditions are in a healthy state of balance at present. Employment is large, prices are relatively stable, and transportation facilities are ample and efficiently operated. Production and inventories, generally, are well controlled, and credit conditions are sound. In the light of the present situation, the expectation of active spring and summer business seems to be justified.

Automobile buying during the last few months has been particularly good, partly as a result of the greater values afforded by the new models and lower closed car prices, partly as a result of better agricultural purchasing power, and partly as the result of the increased general prosperity.

I expect the consumer demand for automobiles to continue to be large while general business remains active. The volume of retail automobile sales for the first half of 1926 is expected to exceed that of the first half of 1925 by a fair margin.

* * *

CENSUS OF MANUFACTURES FOR 1925

The Bureau of Census is preparing to take the next census of manufactures, covering the year 1925. This census is taken every two years, the last year covered being 1923. Blank forms upon which the reports by manufacturers are to be made are now being distributed. A report will be required from each manufacturer whose gross products are valued at $5000 or more in 1925. Machinery builders should endeavor to fill out the schedule within a few days after its receipt, as the tabulation covering different industries cannot be made by the Bureau of Census until reports are received from all manufacturers engaged in a certain industry. The sooner manufacturers furnish this information to the government, the sooner will statistics be available that will show the definite trend of the industry in 1925.

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*Mr. Sloan's statement was received too late to be included in the article "Opinions of Business Leaders," beginning on page 351, and is therefore published separately.

Current Editorial Comment

in the Machine-building and Kindred Industries

NINETEEN HUNDRED AND TWENTY-SIX

The opinions expressed by a large number of clear-headed industrial executives in the leading article of this number of MACHINERY on the business outlook for 1926 are worth reading, as every reader of MACHINERY is affected by general conditions in the metal-working industries.

According to the views of most business leaders, the industries of the United States are now more nearly normal than at any time since 1914. Business is steadier, and the different branches of industry more evenly balanced than at any time since the war.

Some reasons why these business executives expect continued industrial prosperity during 1926 are that there has been no recent over-production, that both manufacturers' and dealers' stocks are comparatively small, that the railroads are in better financial condition than for five years, that they are not threatened by ill-considered legislation and are in a position to carry out important improvements. Employment is general and wages high, which, in turn, means a good purchasing power.

The farmer is suffering in spots, but not so badly as the granger politicians claim. Three years ago average farm product prices were between 40 and 50 per cent higher than pre-war prices, while manufactured goods averaged from 60 to 70 per cent above the 1914 level. Since then there has been a steady increase in the percentage figure for farm products and a steady decrease in the percentage figure for manufactured goods, so that at the present time the two values are nearly the same. This means that the farmer will again enter the market as an important buyer, not only of agricultural machinery and implements but of a great variety of material.

Electric light and power companies are increasing their plants, calling for more equipment. A vast amount of capital is available for safe investment, and interest rates are reasonable. While no boom is looked for or desired, a gradual but steady industrial expansion is expected, which, in turn, is sure to increase the demand for modern machinery to replace the less efficient equipment that cannot be operated profitably under present conditions of keen competition.

* * *

STANDARDIZATION PROGRESSES

Engineers engaged in standardization work should not become discouraged because the progress made is slow. Sometimes years are necessary for an industry to agree on what may appear to be a minor detail in standardization. The work of collecting and sifting all the data about each item, part or operation must be done slowly and with infinite care.

Those engaged in this important undertaking will always be subjected to criticism, and they should accept it without taking offense. Opinions always will vary widely in regard to standardization in the mechanical field, but results of great value have been accomplished in the past, and the future holds greater promise. Much credit is due those men who, in spite of the difficulties and the thanklessness of the task, still give their best efforts to this work. The American Society of Mechanical Engineers, the Society of Automotive Engineers, the American Gear Manufacturers' Association, the American Society for Steel Treating, and the American Society for Testing Materials are among the organizations in the mechanical field that are actively engaged in this commendable work.

COSTLY MISTAKES IN THE SHOP

Errors in machining are always costly. When a piece is spoiled through a mistake in the shop, the loss involves not only the time of the operator who made the mistake, but of the men who performed previous operations on the piece. Sometimes the material scrapped because of a mistake is of greater value than the labor cost; and the overhead costs must be distributed over spoiled as well as perfect work.

A man's sense of responsibility is increased by calling his attention to the actual money value of a mistake he has made, and some plants have been able to decrease the amount of spoiled work by recording and issuing to the men a detailed statement of the cost to the firm of their mistakes. In the tool-room especially, and when working on large forgings or castings, the cost of mistakes may run into very high figures. A slight error on the part of a toolmaker may spoil a die on which several hundred dollars' worth of machining work has been done.

There is nothing which impresses an operator more strongly than to have the cost of a mistake, in dollars and cents, called to his attention. A simple statement of the figures will have a much greater effect upon him than any other method of handling the error.

* * *

BRASS SOMETIMES CHEAPER THAN STEEL

Because brass is a more expensive material than steel, it is generally assumed that all machine parts made from brass must be more expensive than steel parts. It is a curious fact that this is not so, especially in cases where the parts are small and automatic machines can be used in producing them. Then the finished brass part may be cheaper than the same part made from steel, because brass can be cut so much faster than steel that the saving in production costs more than makes up for the additional cost of the material.

Here is a possible economy that manufacturers of small screws, nuts, studs, and other parts that can be rapidly made on automatic screw machines should investigate. Whenever the smaller production cost of these small parts, if made from brass, outweighs the additional cost of the material, they can generally be used; although, of course, there are a few instances where the purpose for which these small parts are intended would require steel as a material.

* * *

A RESEARCH CLEARING HOUSE NEEDED

There is too much duplication of research effort. Similar experiments are undertaken by many manufacturers, and practically the same tests are being made on the same type of apparatus by the different research laboratories of the engineering schools. There is no coordination in this research work, and for that reason a great amount of valuable time and effort is wasted.

There are excellent facilities for all kinds of engineering research work in this country. The Bureau of Standards has an unusually fine equipment, and many of the engineering schools have excellent laboratories, but there is no clearing house for research work. We need, in addition to endowments and funds for conducting research work, an intelligent direction of the facilities already at hand, and the great engineering societies can be of practical service by planning work for manufacturers and organizations, many of which now are working along rather haphazard lines.

QUICK-ACTING TURRET LATHE CHUCK

In planning the tooling for a turret lathe, considerable thought must often be given to the chuck design. Not only must the work be held firmly in order that the cuts can be taken accurately and without thin shells being sprung, but the chuck operation must be as rapid as possible, so as to keep down the floor-to-floor time of the job. At *A*, Fig. 2, is shown a chuck developed for holding a thin-walled brass casting on a Warner & Swasey turret lathe, while Figs. 1 and 3 show the details of this chuck. Identical reference letters in these illustrations refer to the same parts.

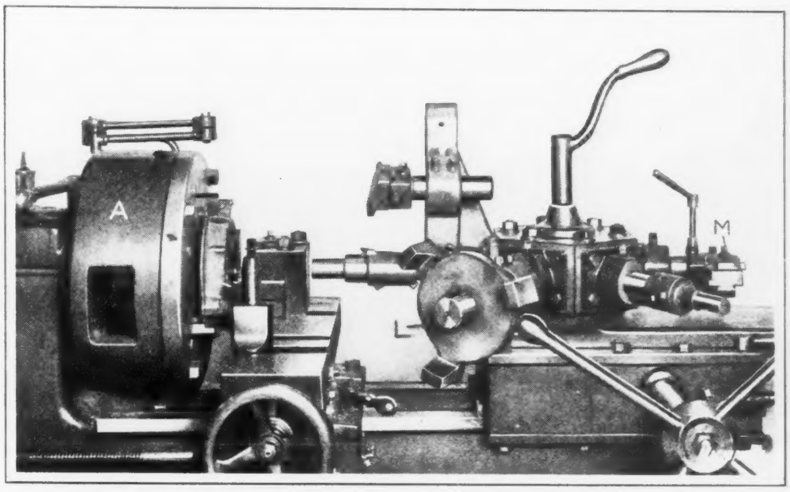


Fig. 2. Arrangement of Special Chuck and Tools used for finishing a Thin-walled Brass Casting on a Turret Lathe

The chuck proper consists of a heavy casting *B*, which is screwed on the nose of the machine spindle. Fastened to the front of this casting, is a plate *C* provided with six slots, which permit the fingers of part *D* to project through the plate when the chuck is assembled on the machine. Part *D* is mounted on the forward end of shaft *E*, which extends through the complete length of the machine spindle

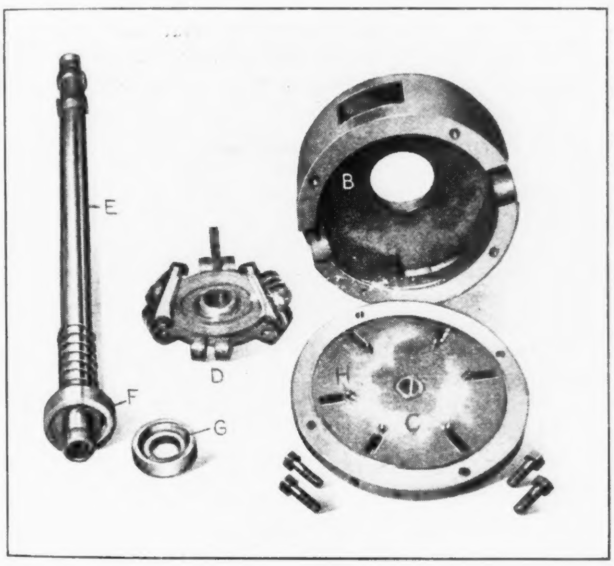


Fig. 1. Parts of the Quick-acting Chuck shown mounted in Place on the Turret Lathe in Fig. 2

and is operated longitudinally by the regular bar chuck mechanism of the turret lathe. Part *D* is positioned on shaft *E* by collars *F* and *G*. Each of these collars has an internal spherical surface that mates with a ball-shaped surface on part *D*. As the hole through part *D* is large enough to afford clearance all around shaft *E* when collar *G* is screwed into place, the spherical surfaces of part *D* and the collars give a free floating action to part *D*. The latter may be equipped with three or six fingers to suit the work.

Shaft *E* is pushed forward to release work from the chuck, and in the opposite direction to clamp work. When the shaft is moved forward, the fingers on part *D* are expanded radially as an angular surface on each finger slides along a ball-end set-screw *H*, the expansion being sufficient for the front end of the finger to clear the flange of the work. Then, when the work has been replaced and shaft *E* is returned, spring-actuated plungers *J* force the fingers of part *D* radially inward to clamp the new piece. The work is seated for the operation on hardened stop-pins *K* located directly under the fingers, so as to have a metal-to-metal contact and eliminate springing the work.

For locating the work centrally in the chuck, use is made of the three-fingered spider *L*, Fig. 2, which is mounted on one face of the turret. The work is simply slipped within the fingers of this spider, the arbor of which extends through the cored hole in the work. Then the turret is advanced to make the spider hold the work against the chuck until the fingers of the chuck have been operated. Boring, turning, reaming, and facing cuts are taken by means of standard tools. At *M* is shown a tool of the rack type, equipped with four cutters for taking roughing and finishing cuts on two central bosses of the work, but a slide tool is now used for this step. All boring and reaming tools are guided by pilots which enter bushing *N*, Fig. 3. The time taken in finishing this casting is 2 1/2 minutes.

* * *

The importance of foreign trade to the American motorcycle industry is evidenced by figures recently published in *Commerce Reports*. During the five years 1920 to 1924, inclusive, this country produced a total of 196,885 motorcycles of which 103,570 or about 53 per cent, were exported. Exports for 1924 amounted to 16,859, compared with 16,339 during the first nine months of 1925, and it is anticipated that the total for 1925 will be approximately 22,000.

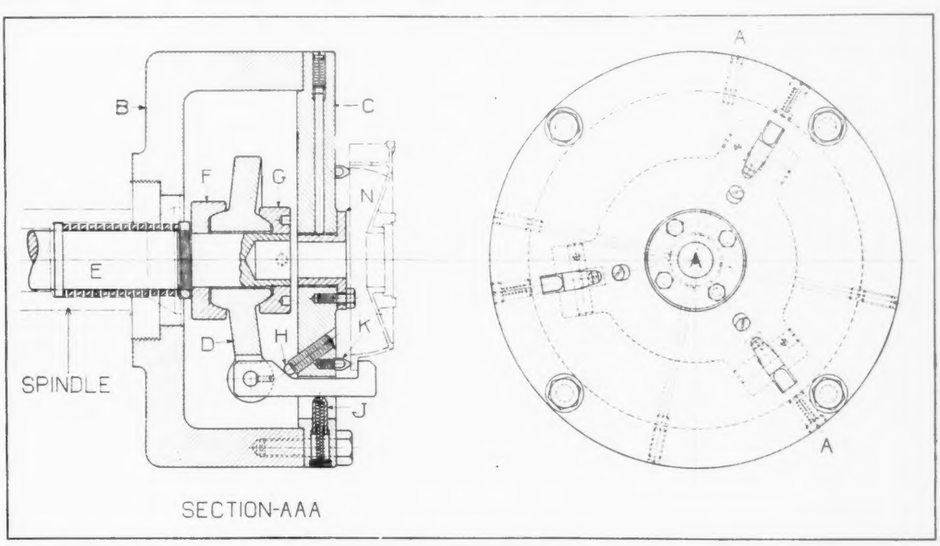
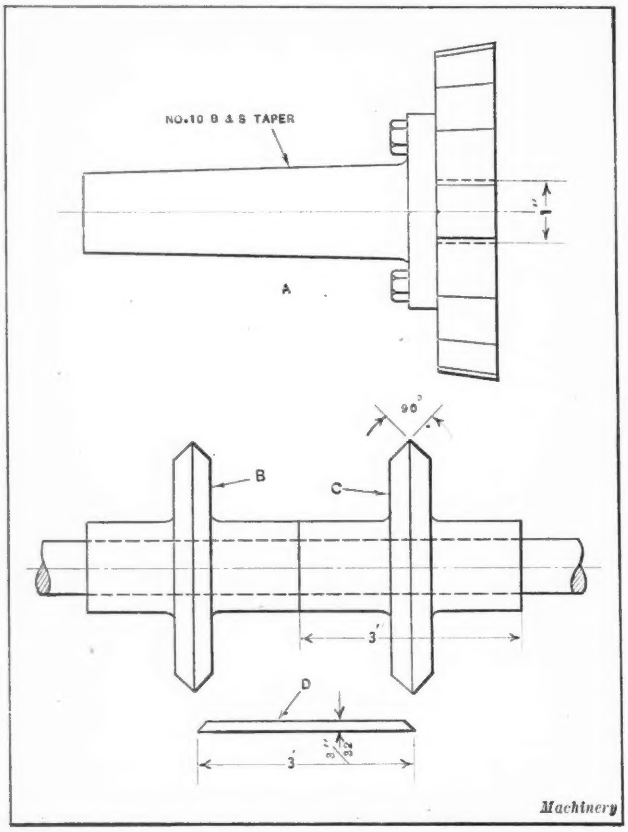


Fig. 3. Details of Construction of Turret Lathe Chuck

REMEDYING MILLING CUTTER TROUBLE

By DONALD A. HAMPSON

A number of inserted-blade end-mills, like the one shown at *A* in the accompanying illustration, are used in one plant for finishing a certain class of work. Originally the end-mill type of cutter was used for finishing surfaces only 2 inches high or less, but as the line of work developed, surfaces over 5 inches high were milled, for which 6-inch cutters were employed. The original arbors that held the cutters were 1 inch in diameter and carried a key for driving the cutter and an end-screw for its retention. When larger cutters were bought, they were used on the same arbors, which seemed to be amply rigid for the work. With an increase in the size of the work milled, errors appeared.



Milling Cutters designed to eliminate Inaccuracies

The machine spindles were carefully checked for fit and alignment, and the cutter-grinding operation was gone over to make sure that no inaccuracy existed there. The work was also rough-ground, top and bottom, to prevent it from being distorted by the clamps. However, inaccuracies still persisted that were not confined to any particular part of the surface milled. For instance, an error of 0.002 inch was sometimes found at the top of the cut and sometimes at the bottom or at one of the ends.

By a process of elimination, it was finally determined that the trouble was with the cutter, which either became distorted under the cut or moved on its arbor. The fit of the cutter on the 1-inch portion of the arbor was loose enough to permit changing cutters, for sharpening purposes, but was not a drive fit. The theory that the cutting stresses produced a weaving action on the cutter, due to a slight looseness on the arbor, and that the low arbor shoulder and the thin-headed retaining screw at the front of the cutter were not adequate, led to the making of two arbors like the one shown at *A*. The flanges on these arbors were a little larger in diameter than half the extreme diameter of the cutter. The same cutter was used in testing out the new arbor, but instead of using an end-screw in the center to retain the cutter, hexagonal cap-screws were run in from the back of the flange as shown. The new arbors served to remedy the trouble.

Cutting and Beveling Thin Stock

Another job of plain milling at the same plant was put upon a trouble-free basis by employing special cutters like the ones shown at *B* and *C*. Strips of cold-rolled sheet metal, about 18 inches long, were to be cut up into pieces that were required to have their edges beveled to an angle of 45 degrees. This was a job that required accuracy, and that had to be performed periodically and at low cost, in order to meet competition.

Anyone who has attempted to cut and measure thin strips with beveled edges knows that it is a difficult task. Rule measurements on the face of the strip are not accurate, and gage and micrometer measurements cause the sharp edges to be crushed, so that accurate measurements are difficult to obtain even if the piece is free from burrs. A gage designed to support the work on one of its flat surfaces, and having gaging points that come in contact with the beveled end surfaces, is the only reliable type to employ for such work. In this plant, four strips of sheet metal were cut from a plate at one operation. The plates were free from buckle, and a satisfactory means of clamping them for their full length had been developed. The unsatisfactory part of the process was the setting up of the 45-degree double cutters employed to cut off and bevel the strips. The largest spacing collars that could be passed over the clamps were employed.

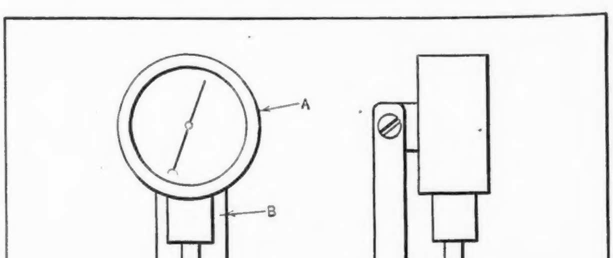
The job of spacing five cutters so that they would cut pieces of uniform width was found to be very difficult. In order to produce plates that were interchangeable, it was necessary to make sure that the cutter would not wobble and that no looseness existed between the cutter and the arbor. The remedy, in this case, was to make the cutters with longer hubs, as shown in the illustration. The longer bearing obtained in this way gave the required stability. The use of long hubs also made it possible to eliminate spacing collars, and thus simplified the setting-up operation. The toolmaker was instructed to make the center of the teeth exactly midway between the hub ends, and the overall length of the hubs alike. Although the new set of cutters was rather expensive, they turned out beveled strips of uniform size, and proved a good investment.

* * *

CONCENTRICITY GAGE FOR BUSHINGS

By LAWSON SHAW

The concentricity gage here illustrated has been found very satisfactory for gaging bushings and other cylindrical parts. In addition to being simple in design and operation, it is inexpensive to construct. The gage consists of a dial indicator *A* which is secured to a standard *B* in which a pin *C* is inserted. The standard *B* is fastened to the base *D* as shown. The part to be gaged is set on the pin *C* and revolved slowly. Any eccentricity will at once be indicated on the dial.



Dial Indicator used to test Concentricity of Bushing

What MACHINERY'S Readers Think

on Subjects of General Interest in the Mechanical Field

WHY HAMPER SKILLED MEN WITH OBSOLETE TOOLS?

A good workman and a good machine form an ideal combination for the success of any production program. The majority of skilled men take pride in their work. They endeavor to improve the quality and the output and they guard jealously the reputation for skill that they have attained. Such men also take pride in the machines that they are using and that aid them in their efforts to produce good work. This teamwork between man and machine, creating as it does pride and confidence on the part of the man, increases shop efficiency, reduces labor turnover, and thereby brings down production costs. Carefully selected, up-to-date machine tools are of great importance in maintaining pride and workmanship in the shop. F. B. H.

* * *

SPARK METHOD OF SELECTING STEELS

The following is intended as a plea for a better general understanding or knowledge of the spark method of determining the nature of a piece of steel. It has always seemed to the writer that this is one branch of the toolmaking trade that is more or less neglected, or not as generally understood as it should be. The average mechanic has a vague idea of the spark test method, but is at a loss when it comes to carrying it out in actual practice. A thorough understanding of the spark test should be a part of the mechanical education of every toolmaker and machinist.

There are instances in the best organized shops when an expensive tool is made from machine steel by a workman who supposed he had a piece of carbon tool steel; or a die is sometimes made from a piece of tool steel that was mistaken for high-speed steel. The regrettable part of these mistakes is that they are seldom discovered until the tool is finished and the hardener finds that he is unable to give the tool the required hardness. We are all familiar with the excuses offered by the workman who made the tool: "I thought it was tool steel"; "It was given to me for tool steel"; or "I made it out of a piece of steel I have had on my bench for quite a while and I thought it was tool steel."

If in doubt as to the nature of the material, it is best to use the spark test, which consists of lightly touching the piece of steel to an emery wheel revolving at high speed, and observing the nature of the sparks that fly from the wheel. These sparks differ for each kind of steel, and with a little practice one can readily distinguish between the four kinds of steel most commonly used in tool-rooms, namely, machine steel, carbon tool steel, high-speed steel, and chrome-vanadium steel. Anyone who is interested can easily learn to distinguish the difference in the kind of sparks these steels produce, by bringing them to bear lightly against the emery wheel and comparing the sparks.

CHARLES DOESCHER

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EXECUTIVE SUPPLY AND DEMAND

From time to time articles have appeared in the technical press in which the question has been raised "Where is our executive material to come from?" Has anyone thought about where our executive material goes to? Each year there is turned loose upon industry a flock of embryo executives and industry itself is producing some, for an analysis of successful executives shows many graduates from the "College of Hard Knocks." If all this available material were placed, we would be officered like a Mexican Army. Where then does it go, aside from the natural depletion?

A perusal of the "Situations Wanted" columns seems to indicate that there is an over-supply in the mechanical field, and this over-supply must be absorbed in subordinate positions or flow to other industries. If this analysis is correct, then it is not a question of supply, but rather what is to be done with the surplus. We frequently see "Help Wanted" advertisements stating that "experienced men only need apply," but frequently the applicant learns that he has too many years of experience whereas the man who wishes to advance is barred because he was not born with experience. On the other hand, we try to sell new customers our products, even though they have not had experience in their use, and claim for our articles superior merits because of the years of experience in their manufacture.

You who have taken engineering courses—where are your classmates? Are they holding executive positions or have they gone into other lines than those for which they prepared, and why? When we go over the list carefully, we see that some chose wisely, while others did not possess the fundamental qualities necessary. It is possible that some, though qualified, have been the victims of personal preference, while the question of remuneration has led others into lines that yield a larger income, and they are not using the technical training they had acquired.

All this means a financial loss to industry if we are to believe what statisticians tell us about the cost of labor turnover, and the loss must be proportionally greater, the higher we ascend the scale. If there existed an infallible agency to direct the aspiring youth in the right channel, the problem would be greatly simplified, provided we could prevent "influence" from fitting square pegs into round holes. With such an agency, energies now going to waste and misapplied would be put to their best use, and supply and demand would be more nearly balanced.

W. W. LAWYER

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HELP MEN TO HELP THEMSELVES

Employers are paying more and more attention to the matter of saving on the part of their employes, and in many of the large plants simple and practical plans have been inaugurated for developing the habit of systematic saving. Some plants operate a kind of savings bank, and have found the idea to work out successfully. It is not intended that these banks should take the place of the regular commercial institutions, but rather to act as adjuncts to them. The idea is simply to encourage the saving habit and make it easy for the employes to put a part of their weekly earnings in the company bank where they know that it will be safe and easily accessible in case of need.

Plants running banks of this kind have found that they can be run at very small cost. In one plant a clerk gives half a day a week to this work. The deposits are made on a given day at certain hours, using deposit slips and pass books as in a regular bank. Interest is figured semi-annually, and if the depositor withdraws his savings before the end of a six-month period he loses the interest. This encourages the leaving of the savings intact for a period of time, until the real saving habit has been established.

It has become more and more obvious that the paternalistic form of welfare work is not desirable. The best way to secure real cooperation is to engage only in activities through which the employes are enabled to do things for themselves. W. D.

January 1926 MACHINERY'S SCRAP-BOOK

SUB-PRESS DIES

The sub-press is not a type of die, but rather a method of constructing dies so that the upper and lower members are combined in one self-contained unit and held in accurate alignment. The fact that the sub-press is a self-contained tool and is not dependent upon the power press in which it is used (except for motion), combined with the ease with which a sub-press can be arranged for use, means not only accuracy, but a great saving in time, because in setting up the sub-press it is simply necessary to slide the head of the punch plunger into a T-slot in the press slide, clamp the base to the bed of the press, and adjust the stroke. The sub-press die was originated in watch and clock factories for performing blanking operations requiring great accuracy, and, at the present time, dies built on the sub-press principle are employed for a great variety of work in connection with many different lines of manufacturing. The sub-press is invaluable not only for blanking the delicate wheels and gears of watch and clock movements, but for producing the numerous small parts such as are required for time-recorders, electrical instruments, meters, cyclometers, and a great many other similar devices.

HAULAGE ROPE

Wire ropes made from six strands of seven wires each are known as "haulage" rope, and also as "transmission" or "standing" rope. This type of rope is not very flexible, and is generally made with large wires, in order to enable it to resist a great deal of external wear. It is used when the abrasive action is great but when the rope is not required to bend over many sheaves and when the diameter of the sheaves is comparatively large.

ELECTRIC SOLDERING

The general method of electric soldering consists of holding the pieces to be joined by clamping jaws with the ends of the work in firm contact; a heavy current of electricity, regulated to heat the joint sufficiently to melt the solder, is next passed through the work. The solder, in the form of tape or wire, is then applied to the joint. It flows in and around all parts heated to the proper temperature, as when using a gas flame, but the "life" or temper is retained in pieces that have been electrically soldered, instead of their being left in an annealed condition as when heated with a flame. Practically all the metals, such as brass, copper, steel, German silver, gold, and silver can be soldered successfully by means of the electric soldering process; this method is the most economical for a continuous run of work. The current used for electrical soldering should be a single-phase alternating current of any frequency between 40 and 60. A higher frequency could be used, but it is not good practice.

REPEATED STRESS TESTS

With the repeated-stress method of testing, a test specimen is held firmly, and a load not sufficient to rupture it is applied, released, and applied again, this procedure being rapidly repeated a large number of times; or the specimen may be strained in one direction, released, and strained in the opposite direction, then released again and strained in the first direction, this procedure being repeated a great number of times. A record is made of the method of loading and the number of alternations necessary to cause breakage or, as it is commonly termed, "failure." The object of repeated-stress tests is to determine as nearly as possible the probable action or life of a given material under assumed working conditions. The methods used vary greatly.

MAGNETIC DEGREE

The 360th part of the angle subtended, at the axis of an electrical machine by a pair of its field poles, is designated as a "magnetic degree." One mechanical degree is thus equal to as many magnetic degrees as there are pairs of poles in the machine.

CALIBRATION

Calibration, in its mechanical sense, denotes an accurate comparison of any measuring instrument with a standard, and more particularly the determination of the errors of a scale used in a measuring device. The method used in calibrating any measuring instrument is generally divisible into two parts, of which one or the other may often be omitted. The first step is to determine the value of the unit to which the measurements are referred, by comparison with a standard unit of the same kind. This part is known as the "standardization" of the instrument, or the determination of a "reduction factor." The second step consists in the verification of the accuracy of the subdivision of the scale of the instrument, which is the actual calibration of the scale, and which does not necessarily involve a comparison of the instrument with any independent standard, but merely a determination of the relative accuracy of the graduations. In many cases, the process of calibration consists of a comparison of the instrument to be tested with a standard, covering the whole range of the graduations on the standard, the relative values of the subdivisions of the standard itself having been previously tested.

The usual method of calibration is the direct comparison of an instrument with a standard over the whole range of its scale. The standard itself should be previously calibrated so that its accuracy, or the amount of its errors, are known. The term "calibration" refers not only to measurements of length, but to measurements of all other engineering units; thus, for example, ammeters, voltmeters, pyrometers, dynamometers, and all other measuring instruments, are calibrated by a comparison with a standard.

GEAR-CHUCKING METHODS

The following methods have been employed for holding gears while grinding the shaft holes: (1) Holding the gear by the outside diameter or tops of the teeth. (2) Using rolls between the teeth—sometimes called the "pitch-line control method." (3) Using jaws of special shape, which make contact with the gear at the bottom of the tooth spaces—a method known as "root control." The first method cannot be used with success when the gears are to run at high speeds, because of the possible lack of concentricity between the hole and the working surfaces of the teeth. The second method, while requiring the use of a more expensive chuck, is much more satisfactory than the first, provided the spacing of the teeth has not been affected by hardening and the rolls are uniform in diameter and supported by a truly concentric surface. A slight variation in the width of the tooth spaces, however, makes a considerable difference in the relative position of the rolls, owing to the acute angle made by the tooth surfaces near the pitch line where the rolls bear. This has been considered, by some manufacturers, a serious objection to this method. For the average line of work, the third method is recommended. The jaws of the chuck engage the bottom of the tooth spaces, so that inaccuracies of spacing, due to hardening the teeth, do not affect the accurate holding of the gear; furthermore, it is a very simple matter to maintain the accuracy of the jaws by simply truing the contact points whenever necessary.

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TAPPER TAPS

The name "tapper tap," as understood by toolmakers and tap manufacturers, is applied to one of two kinds of taps used for tapping nuts in tapping machines. It is often confused with the expression "machine nut tap," which properly designates the second kind of taps used for this purpose. The machine nut tap, however, differs from the tapper tap in a number of particulars, the most important of which are the number and the form of the flutes, the relief of the threads, and the general design. The tapper tap is simpler in its details. Tapper taps, as a rule, are relieved only on the top of the thread of the chamfered portion. They are not relieved in the angle of the thread. The straight part, which performs no cutting, forming only the sizing part of the tap, should not be relieved, or, if relieved, the relief should be very slight in order to permit the tap to retain its size longer.

SILUNDUM

Silundum is a trade name for silicified carbon obtained by heating carbon rods in silicon vapor in an electric furnace. Being a form of carborundum, it has the same properties; it is very hard and acid-proof and resists high temperatures. It can be heated in the air to 1600 degrees C. (2912 degrees F.) without oxidation. Silundum rods have about three times the resistance of carbon; they are used in electrical heating and cooking devices, and are made in round, flat, and square bars or tubes and in the form of grids.

RUBBER

Rubber is obtained from certain trees and bushes found in the tropical regions of America, Africa, and Asia. Commercial rubber contains a number of foreign substances which can be removed by mechanical washing and drying. The washed and dried rubber is then treated according to the purpose for which it is to be used. In engineering, one of the most common uses of rubber is for electrical insulation. When rubber is to be used for this purpose, the washed and dried product is passed between rollers and pressed into sheets, after which it is cut up into pieces, again passed through the rollers, and compounded with various mineral substances, hydrocarbons, and sulphur, this process being known as "compounding." From 60 to 70 per cent of mineral substances may be added to the rubber gum before the essential qualities of the rubber cease to predominate. Commercial insulating rubber, for example, generally contains only about 30 per cent of rubber, while it may contain from 30 to 65 per cent of zinc oxide, up to 30 per cent of whiting, from 1 to 12 per cent of litharge, from 2 to 4 per cent of paraffin, and from 2 to 4 per cent of sulphur. A number of other substances are also present in small quantities. "Hard rubber" is defined as a rubber compound hard enough to be machined and polished. Hard rubber is vulcanized—that is, the soft rubber has been treated with sulphur so as to change it into a harder product than the original rubber.

ABSOLUTE TEMPERATURE AND ABSOLUTE ZERO

A point has been determined on the thermometer scale, by theoretical considerations, which is called the "absolute zero" and beyond which a further decrease in temperature is inconceivable. This point is located at —273 degrees C. or —459.2 degrees F. A temperature reckoned from this point, instead of from the zero on the ordinary thermometers, is called "absolute temperature." To find the absolute temperature when the temperature in degrees F. is known, add 459.2 to the number of degrees F.

GRINDSTONE MOUNTING

The tendency for cracks to start in grindstones can be overcome by a proper method of mounting. It is good practice to fill the central space around the arbor with cement or lead after the stone is centered. Wooden wedges should never be used. The stone should be supported by flanges of generous proportions, and wooden washers from 1/2 to 1 inch in thickness (or a double thickness of leather or rubber) should be inserted between the flanges and the stone to compensate for surface inequalities.

DUTY OF STEAM PUMPS

The duty of a pump represents the relation between the amount of work done by the pump and the amount of coal, steam, or number of heat units required for driving the pump. The duty may also be based upon the volume or weight of water pumped, in comparing the performance of a plant at different periods. If one pumping engine performs 130,000,000 foot-pounds of work during a given time, and the amount of coal or steam required is less than for another pumping engine operating under like conditions, obviously the former installation is more economical. The duty alone, however, is not the only factor to be considered. The duty of one pumping plant may be considerably higher than that of another, but there may also be a great difference in their relative initial costs. The more expensive plant might in some cases effect such a saving in coal consumption annually as to much more than offset the difference in initial cost, whereas, in other installations, a high duty might be purchased at too great a cost, especially if the service is severe and the high duty is obtained by an intricate or delicate mechanism that requires frequent repairs or renewal.

RIVETED JOINTS CLASSIFIED

When plates to be joined by riveting overlap each other and are held together by one or more rows of rivets, a "lap joint" is formed. In a "butt joint" the plates are in the same plane and are united by a cover plate or butt strap, which is riveted to each plate. A combination lap joint consists of a cover plate inside or outside the lap, and three rows of rivets, the central row passing through the two plates and the cover, and having twice as many rivets as the other two rows. The term "single riveting" means one row of rivets in a lap joint or one row on each side of a butt joint; "double riveting" means two rows of rivets in a lap joint or two rows on each side of the joint in butt riveting. Joints are also triple and quadruple riveted.

SEMI-STEEL

Semi-steel is made by adding mild steel to the pig iron and scrap in the cupola. The proportion of steel used varies from 15 per cent for light castings to 40 per cent for heavy castings. The resulting metal is a high-grade cast iron with fewer impurities and better physical structure than ordinary cast iron, and while this metal has practically no elongation or ductility, it is stronger than gray cast iron under transverse, tensile, compression, and impact tests, and is superior in elasticity, toughness, and resistance to shock and wear. When properly made, it is close-grained, homogeneous, and free from hard spots and blow-holes. It is greatly superior to gray iron for machinery, and takes on a finer polish, and permits the cutting of clean screw threads. It is especially good for such castings as cylinders, pistons, and gears, and other parts which are subjected to wear and friction. The 20 per cent mixture usually gives the desired results for machine tool work.

DOUBLE TRUNNION DRILL JIG

By K. M. BOWLBY

The jig shown in Fig. 1 is of the double trunnion pin type; that is, it is so designed that the work is brought into position for drilling the various holes by means of two swiveling frames which are positioned by the required number of properly located index-pins. The inner frame, or work-holder, can be swiveled within the outer frame, which, in turn, can be swiveled in the body of the jig. The work for which the jig was designed is shown in Fig. 2. Other parts of a similar type have also been successfully drilled on the same kind of jig, the basic principles of which may well be incorporated in jigs intended for work of a similar nature.

At least two jigs of the usual design would be required to perform the work handled in the jig shown in Fig. 1. The part to be drilled is bucket-shaped with holes in the top, bottom, and body wall, as indicated in Fig. 2. The close spacing of the holes in the wall prevents the use of the conventional box type of jig having from four to six sides. Very close spacing of the holes is possible with the trunnion type of jig if the index-pins *F* and *G* (Fig. 1) on each side of the locating plate disk are staggered. In this particular case, the work (shown by dot-and-dash lines) is clamped in the inner holder *A*, which can be pivoted on the trunnions *B* and is locked in any one of three positions by the index-pin *C*. The outer frame *D*, which carries the holder *A*, is, in turn, pivoted on the trunnions *E*, which permit it to be indexed a complete revolution. The index-pins *F* and *G* and the bushed index-holes in the frame provide for locating the outer frame in any of four positions, spaced 90 degrees apart. One of the advantages of a drill jig of this type is that the operator is not required to roll or turn over the heavy jig every time a new hole is drilled.

The base of the drill jig should be properly ribbed, allowance being made for finish cuts only on the outside rim and through the center sections. It is preferable that the castings be aged or heat-treated after partial machining, in order to prevent warpage. However, if the ribs are designed correctly and the castings properly stored, no trouble should be experienced from this source. Proper storage requires that the base, especially, be placed on a plain flat surface.

Trunnion and Index Pins

The trunnion pins are hardened and are provided with steel bushings, if the quantity of work warrants the additional expense. The fixed ends of the pins can be pressed directly into the hole in the casting. The index-pins are hardened and fit into steel bushings placed in the movable and fixed members. These bushings can, of course, be replaced when they become worn. The bushings that govern the position of the outer frame and the central holder are set below the disk plate surface. This allows the locating pin to ride on the disk, and thus permits the operator to use both hands in swinging the frame around. The set-in bushing also provides a clearance, which allows for the nominal wear on the disk. Many designers prefer tapered end plungers for indexing purposes, but it is the writer's opinion that, as dirt is sure to get on the plungers, the straight type is better. If properly fitted, dirt cannot possibly affect the accuracy when the latter type of plunger is used, whereas a very little dust will cause inaccuracies when the tapered type is employed.

The hand-operated plunger *G* used in connection with the lever-actuated index-pin *F* gives additional rigidity. A withdrawal stop should be provided for the hand-operated plunger in order to eliminate the necessity of replacing the pin after each indexing movement. The rotating members of the jig are balanced both with and without the work in place. Balancing is necessary to insure safety and ease of operation. The heavy frames, if allowed to swing too fast, will imperil the operator and will shorten the life of the jig.

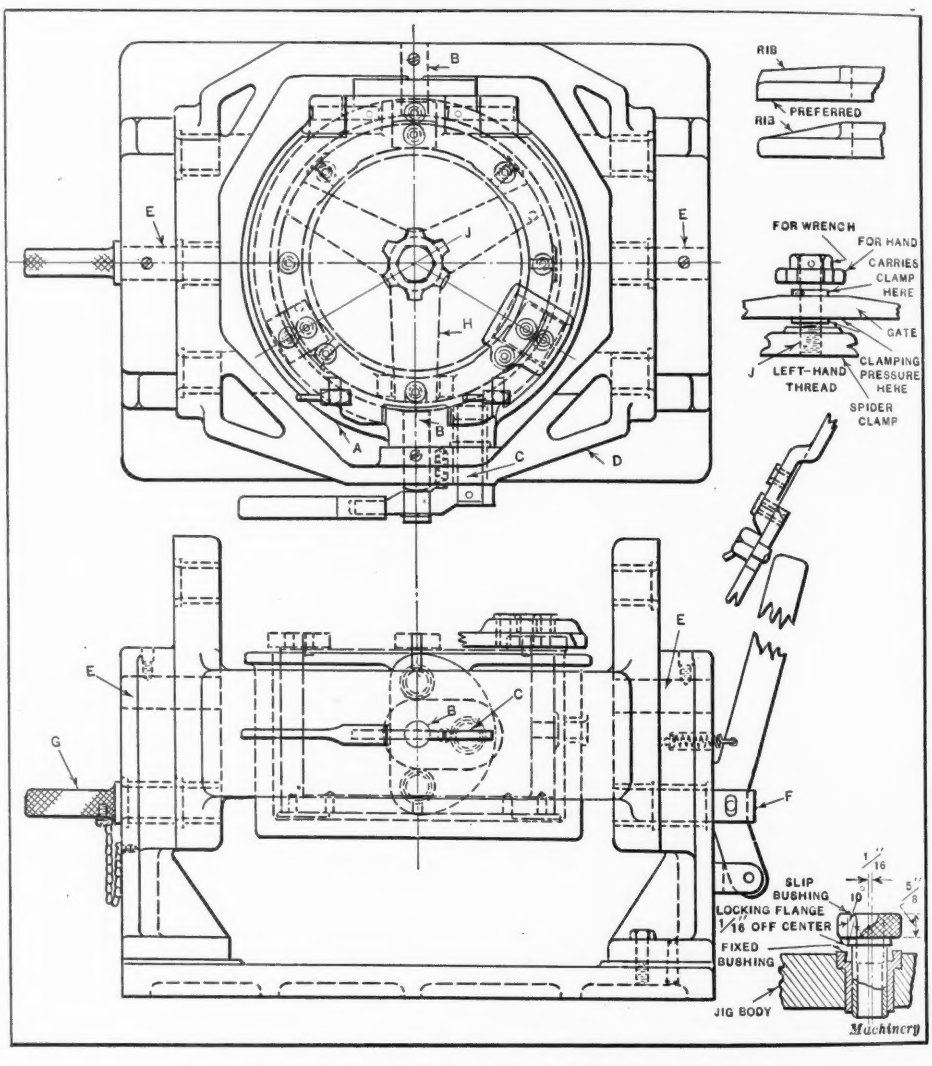

Fig. 1. Double Trunnion Drill Jig designed for Work shown in Fig. 2

Method of Clamping the Work

The work is held in place by a gate provided with a spider clamp *H*. Careful ribbing of the gate is necessary, as the spider clamp has a tendency to spring or arch the gate, which would result in locating the holes inaccurately. The ribs should be designed as shown in the upper right-hand corner of the illustration, preferably with a blunt end, as indicated in the upper view. For small work, the gate can be held shut by quarter-turn screws, but for large work this method is not desirable, as the screws wear too rapidly on their working faces and they also cause excessive wear on the tapped holes in the iron casting. The latter difficulty can be remedied, however, by the provision of a shoulder bushing pressed into the jig from the bottom or inner side.

The I-bolt and hand clamping knob, with provision for the application of a wrench, provide the most desirable means for clamping the gate in place, as the parts subjected to wear can be easily replaced. The gate, as well as all moving parts, should be provided with oil-holes.

Hinge Pins

The diameter of the hinge pin on the gate should be large enough to provide sufficient rigidity, and it should be short enough to permit line boring and reaming of the hinge members. For instance, a 5/8-inch diameter pin should not require line boring and reaming for a distance as great as 6 inches, as the boring tool would be likely to spring, which would result in an inaccurate job. On the single hinge-pin type where the pin is supported in two bearings and the gate rotates on the pin, the latter member should be a press fit in the first bearing, a light turning fit in the gate, and a light push fit in the second bearing. This is, of course, a problem that should be taken care of in the tool-room. The spider clamp is made from forged steel of suitable weight, and is clamped by hand and by the application of a wrench. A left-hand thread is employed on the screw *J* to permit tightening the clamp by a natural right-hand turn of the screw.

When various holes are to be drilled, the length of the bushings can be made nearly uniform. Proper design in this respect will allow one setting of the drill spindle to serve for many changes of drills, which may be used with or without extension attachments. Too often jigs are designed without taking into consideration the sequence of operations and the effect they have upon the method of locating the work. There are cases when it would not be wise to design an expensive tool for drilling unimportant holes, if, by providing long-length drill bushings, a portable drill could be employed. The bushings would in this case be considered part of the jig. A simple and effective slip bushing of the cam-locking type is shown in the lower right-hand corner of Fig. 1. Cored openings should be provided near the base of the jig body for the removal of chips and for admitting light.

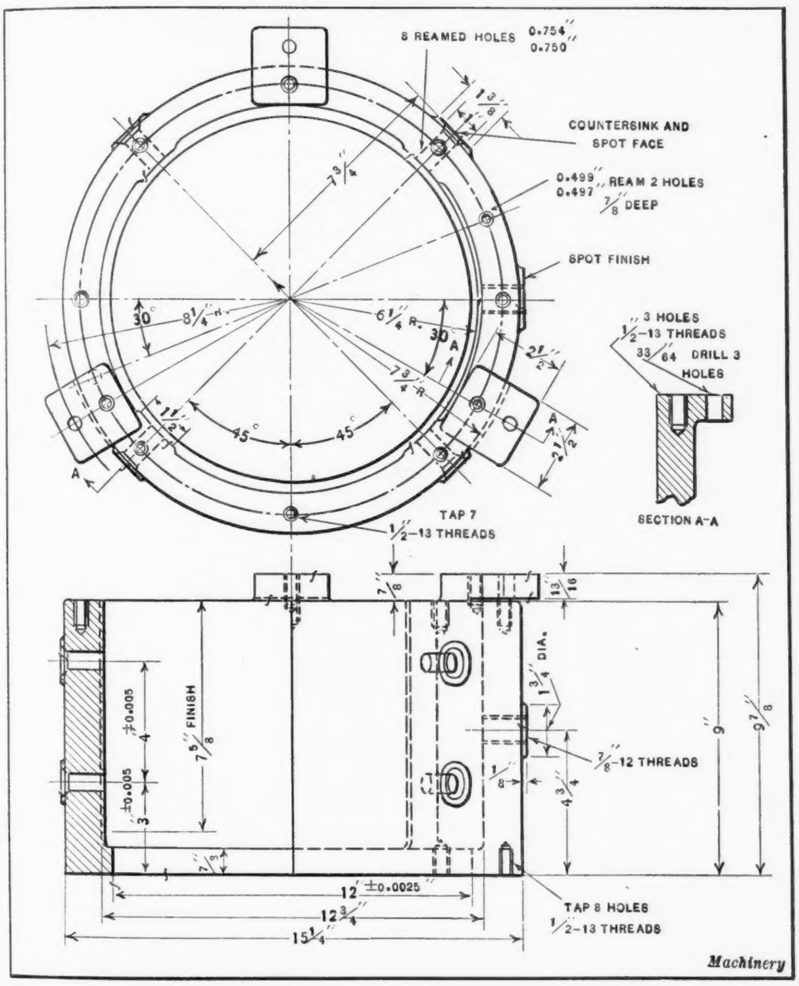

Fig. 2. Work drilled, reamed, spot-faced, and tapped in Jig shown in Fig. 1

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WIRE ROPE MATERIALS

The following information on materials used for wire rope and the practical applications of different materials is from the United States Government specifications:

Material—The strength of wire rope increases in the following order: Phosphor-bronze, cast steel, extra strong cast steel, plow steel, high-grade plow steel. The weight and the diameter of a wire rope for a particular purpose can be reduced by using a stronger material, as, for example, by using a plow steel instead of an extra strong cast-steel rope. Or, by using a stronger material the strength and, therefore, the safe working load can be increased for a given weight and diameter.

Galvanized Wire Rope—Galvanized wire rope should be used if the rope is likely to corrode because of the presence of moisture, as for the standing rigging of a ship. Because the zinc coating is rapidly removed by wear, it should not, in general, be used for hoisting. It may, however, be used for the running rigging and for wheel (steering) ropes on ships, as these ropes do not wear rapidly.

Uncoated Wire Rope—Uncoated wire rope should be used where it is protected from moisture, as in a building, and for more or less continuous hoisting. It may be used instead of galvanized wire rope where it is exposed to moisture, as for derrick guys, if a protective coating is applied to the rope at regular intervals.

Phosphor-bronze Wire Rope—Phosphor-bronze wire rope has lower strength than steel wire rope; therefore, the working loads should be lower. The sheaves should also be larger than those for steel rope. It is non-magnetic, and can be used for conditions under which galvanized steel rope does not give satisfaction. Because of these properties, it is used on small vessels.

Marline-covered Wire Rope—Marline-covered wire rope is stronger and more durable than manila rope. The marline covering prevents wearing of the wires and supplies lubricant to them. As the marline wears to a smooth surface, the rope is easily handled or laid in a flat coil. Compared with uncovered wire rope, the marline-covered rope is more easily handled, has greater friction, which is an advantage if it is used on a smooth drum, and is more durable, particularly if it is exposed to gases, grit, or moisture.

* * *

The annual meeting of the Taylor Society (an international organization for the promotion of better management) was held at the Engineering Societies Building, December 2 to 5. A special session for teachers of management was held on December 2, and a joint session with the management division of the American Society of Mechanical Engineers was held on December 3. Among the papers read at the latter session were: "The Influence of Plant Design on Plant Efficiency," by Harold T. Moore, industrial engineer, Day & Zimmerman, Inc.; "Carbon-dioxide as an Index of Fatigue," by Walter N. Polakov, consulting engineer; "The Present State of Industrial Psychology," by Lillian M. Gilbreth, of Gilbreth, Inc.; "Labor's Ideals Concerning Management," by William Green, president of the American Federation of Labor.

Testing Spur and Helical Gears or Cutters

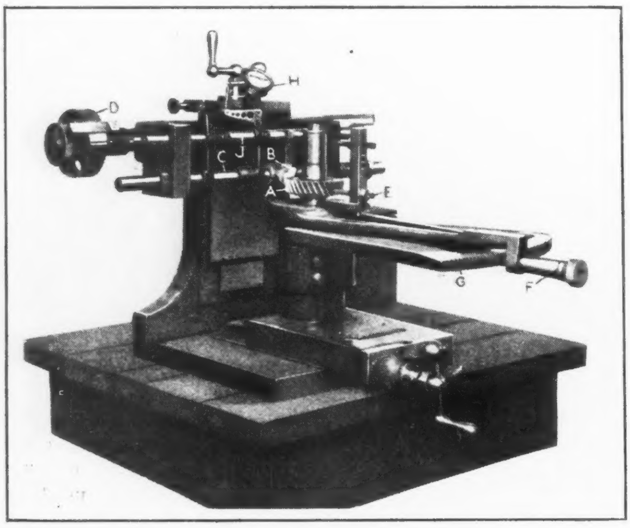


Fig. 1. Special Machine used for checking the Involute of Teeth on Spur or Helical Gears and Gear-shaper Cutters

TWO machines used in the tool-room of the Maxwell Motor Corporation, Detroit, Mich., for determining the accuracy of spur and helical gears and gear-shaper cutters are shown in the accompanying illustrations. The one shown in Figs. 1 and 2 was built especially by the Gear Grinding Machine Co., Detroit, Mich., for checking the tooth form. The gear or cutter is placed on the vertical arbor, as shown at *A*, and locked in place by tightening the nut at the upper end of the arbor. Slide *K* to which the arbor and the large gear segment *G* are attached is then moved forward to engage one side of a tooth on the gear being tested with rack tooth *B*. The latter has a pressure angle of 14 1/2 degrees, and is shown in Fig. 2 arranged for checking the form of the left-hand side of the gear teeth. The rack tooth is held in bracket *L*, which is fastened by means of set-screws to rod *C*. Spring *M* and a collar on this rod hold the rack tooth against the flank of the cutter tooth at the proper pressure.

Micrometer wheel *D* is next turned until the zero graduation on it coincides with the zero mark on scale *N*. As the wheel is revolved, screw *S* is advanced or withdrawn, depending upon the direction in which wheel *D* is rotated. Upper rod *J* is then set against the end of screw *S*, and held in contact with it by the action of spring *O*. Screw *P* mounted in bracket *T* attached to rod *J* is next advanced to contact with amplifying lever *Q*, the upper end of which bears against the feeler of indicator *H*. Screw *P* should be advanced sufficiently to cause the needle to make approximately one revolution and stop at the zero graduation on the dial. Both the indicator and amplifying device are attached to bracket *R*, which is fastened by means of set-screws to the lower rod *C*.

Making a Test

Wheel *D* is next revolved to advance screw *S* an amount equal to the chord of an arc of one degree around the pitch circle of the cutter or gear being inspected. As the graduations on wheel *D* each represent a movement of only 0.0002 inch of screw *S*, and one revolution of the wheel represents only 0.050 inch, it is an easy matter to turn wheel *D* the desired amount. When screw *S* advances, rod *J*, bracket *T*, and screw *P* are moved with it so that, obviously, amplifying lever *Q* causes the needle of indicator *H* to register in ten-thousandths of an inch the amount that screw *S* was advanced.

Plunger *F* is next withdrawn from the tooth space it engages in segment *G*, and moved into the next tooth space to advance the gear or cutter tooth under inspection one degree. Rack tooth *B*, rod *C*, and bracket *R* move longitudinally, due to the action of spring *M*, an amount equal to the chord of the arc through which the gear or cutter tooth is moved. With the movement of bracket *R* there is necessarily a like movement of the feeler of indicator *H*. Hence, if the involute of the gear or cutter tooth is correct, the indicator needle will register zero, as it did before the micrometer wheel *D* was revolved, but if an error exists in the involute, the amount, plus or minus, will be shown by the indicator needle.

The steps outlined are continued on any tooth of the gear or cutter until the point of the tooth rests on the rack tooth.

Using the Machine as a Comparator

The method just described is followed only in checking the teeth of a master gear or cutter, or only one of a kind. Testing a number of gears or cutters of the same size is quickly accomplished by placing a master in the position illustrated, and then mounting the gear or cutter to be checked on the same arbor, but high enough so that its teeth can be engaged by a second rack tooth held in a bracket mounted on rod *J*. Then when plunger *F* is withdrawn to move it along segment *G*, rods *C* and *J* move simultaneously. If the tooth contour being checked is correct, the indicator needle will remain stationary during the movement of the two rods, but any error in the tooth contour will cause rod *J* to advance either more or less than rod *C* and the difference will be registered on the indicator. Thus it will be seen that when the machine is used as a comparator, it is not necessary to change the setting of wheel *D*.

Checking the Spacing and Concentricity of the Teeth

A device used for checking the spacing of teeth, and sometimes the concentricity, is illustrated in Fig. 3. It may be used for both spur and helical gears or gear-shaper cutters.

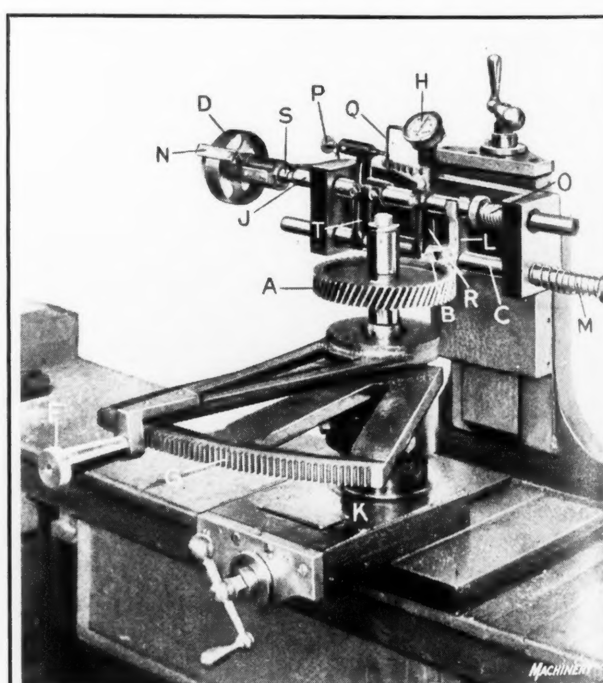


Fig. 2. Close-up View of the Involute-testing Machine illustrated in Fig. 1

The cutter is mounted on a stand *A*, which is swiveled on the baseplate to suit the helix of the cutter teeth, and then locked in place. Graduations along the front of the flange of the stand are used in conjunction with a scribed line on the small block in making this setting. There is an inner plunger in the instrument proper to which feeler *B* is fastened, and an outer plunger surrounding the inner plunger, to which is secured the bracket containing feeler *C*. The space between the feelers and the diameter of the feeler balls are such that the balls are tangent with the cutter at the pitch line, if the cutter teeth are properly spaced.

In testing a tooth, first the right-hand feeler seats, and then the left-hand feeler, the latter being connected to the indicator at the top of the instrument, so that if it does not seat properly, the variation in the tooth width will be shown by the indicator. The latter is calibrated to register to 0.0001 inch. For gaging successive teeth, the two plungers are raised and lowered by turning wheel *D*, which rotates a small pinion up and down on a rack. In order that the device may be used for cutters of different diameters, the plunger unit can be positioned at various heights. Different work-holding adapters can also be used to permit the inspection of bevel gears.

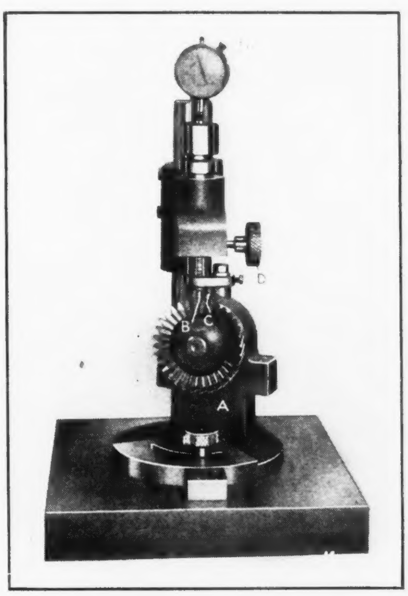


Fig. 3. Instrument used for checking the Tooth Spacing of Spur or Helical Gears and Gear-shaper Cutters

Using an Optical Micrometer

Fig. 4 shows a toolmaker's optical micrometer used in the same tool-room as the other instruments described. This is a convenient device for accurately checking both linear and angular measurements of small gages, screw threads, etc. The work is placed on the table, as shown at *A*, and shifted longitudinally and laterally by turning micrometer screws, which are graduated to 0.001 inch but which permit closer measurements to be accurately estimated. The user looks through the eye-piece at the work, which appears enlarged. There are cross-lines in the instrument that are lined up with surfaces on the work, and by shifting the work to bring other surfaces into alignment with the cross-lines, linear measurements can be made. The particular piece of work illustrated is a gage used for checking the splines of rear axle drive shafts. The splines of this gage are chamfered 45 degrees at the corners, and this instrument has been found convenient for checking these corners.

* * *

Cooperation between the railroads and motor truck operators in handling freight appears to be an important development in establishing economical transportation. In a paper by Joseph L. Scott, on freight handling with trucks, presented at the Automotive Transportation meeting of the Society of Automotive Engineers, in Philadelphia, the results of such an arrangement on several divisions of the Pennsylvania Railroad are described. Mr. Scott concludes, from his observations, that all motor operations should come under state or federal regulations, and that no one should be allowed to operate a motor vehicle in a common carrier service without proper financial standing and without carrying such insurance as may be prescribed by law. The motor truck manufacturers should also see that the truck equipment is placed in the hands of competent operators.

GERMAN AND FRENCH EXPORTS AND IMPORTS OF MACHINE TOOLS

According to statistics of German exports of machine tools for 1924, made available through the Department of Commerce, Germany's five leading customers for machine tools in the order of their importance were as follows: Sweden, Austria, Switzerland, Italy and Holland. American purchases of German machine tools were very small, the United States not being included in the thirteen leading customers upon which reports are being made. The tonnage of the exports in 1924 was only equivalent to 46 per cent of the 1913 exports. The value was equivalent to 65 per cent of the 1913 figure. This indicates that on a pound-basis, the price of German machine tools in 1924 was 41 per cent higher than the 1913 price.

During 1924, Germany imported 1874 machine tools valued at about 2,500,000 gold marks ($600,000). Of these imports the United States supplied the largest amount, Switzerland being the second, and Holland the third most important supplier of machine tools to Germany. It is probable that some of the imports listed as coming from Holland also included American-made machines. It is of interest to note that these imports were only about one-sixth of the imports in 1913, figured on a tonnage basis.

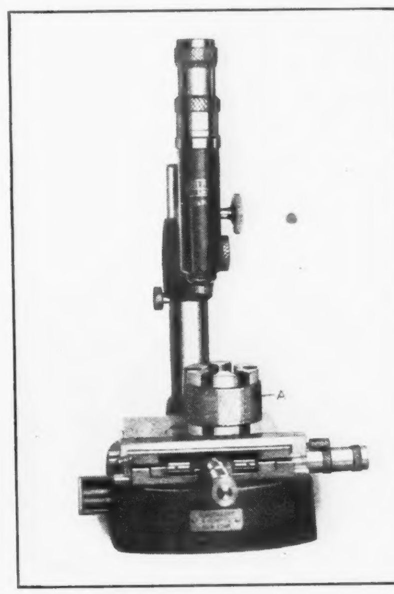


Fig. 4. Toolmaker's Optical Micrometer for checking the Measurements of Small Gages, Screw Threads, etc.

In the first six months of 1925, German imports of machine tools rose rapidly, the value being estimated at $1,700,000. Of the machines imported during 1925, the United States supplied more than one-half, Switzerland supplied about one-tenth, and Great Britain somewhat less than one-tenth.

A comparison of the imports of machine tools into France during the first six months of the years 1924 and 1925, according to information furnished by Wilson K. Ray, assistant trade commissioner, Paris, France, shows a decrease of 720 metric tons during the first half of this year, but the tonnage supplied by the United States shows an increase. In that period of the year 1924, Germany, Belgium, Great Britain, the United States, and Switzerland ranked in the order named as the main sources of supply.

Germany, supplying 1962 metric tons, and the United States, 1864 metric tons, headed the list during the first six months of 1925. The amount from Germany was practically the same as for the January to July period of 1924, while the United States figure shows an increase of 78 per cent. Imports from Great Britain and Belgium declined almost 50 per cent, while those from Switzerland increased slightly.

Exports of machine tools from France during the first six months of 1925 amounted to 5057 metric tons, an increase of 701 metric tons over the 4356 tons exported during the same period of 1924. Belgium, taking 1554 metric tons from January to July, 1924, and 1115 metric tons in the same months of 1925, was by far France's best customer. The outstanding feature of the 1925 exports is that Poland imported 770 metric tons as against only 9 metric tons in the same period of 1924, and occupies second position in the 1925 figures, Spain, Great Britain, Algeria, and the Argentine following.

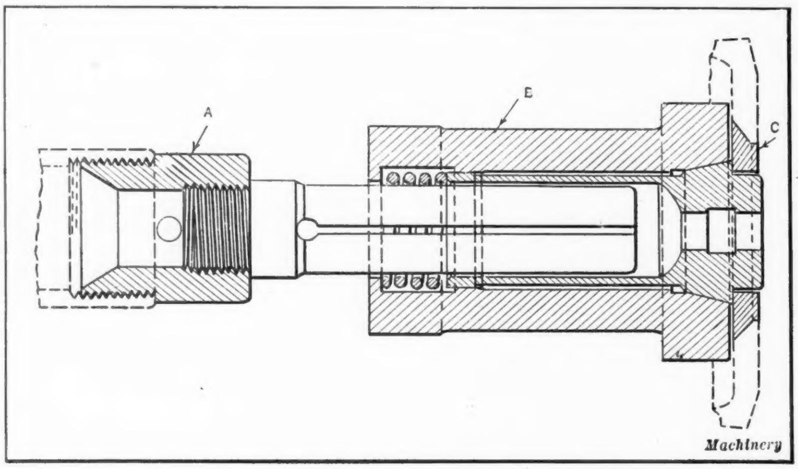
COLLET ADAPTERS FOR SCREW MACHINES

By HENRY SIMON

In any shop producing large quantities of different screw machine products, a great number of collets and feeding fingers must be kept on hand, and this represents, even for the smaller machines, an investment of several hundred dollars. Many of these collets and fingers, especially those of the smaller fractional sizes, such as thirty-seconds inch and smaller, are idle most of the time, while frequently the same size must be duplicated in a larger machine, because the article to be made is too long to be produced on the smaller machine, or the thread to be cut is too heavy, though the machine will take the stock. These requirements still further increase the amount of this type of equipment, which, in the average shop, is idle the greater part of the time.

In view of this, the feeding finger and collet adapter set described in this article should be welcomed by many concerns, inasmuch as, at small expense, it not only offers a simple way of putting idle equipment to work and avoiding unnecessary outlay of money for equipment that is seldom used, but also gives quick relief in many cases where trouble and delay would otherwise occur.

The adapter outfit here illustrated was designed for B. & S. automatic screw machines, the particular machines in this case being a No. 2 and a No. 4. As will be seen, the set consists of three parts, a feeding finger adapter *A*, built upon the principle of a reducing bushing, a chuck sleeve *B*, made with its external dimensions corresponding to those of the larger machine, and the internal dimensions corresponding to those of the smaller machine; and a chuck cap adapter *C* for reducing the chuck cap opening of the larger automatic to that of the smaller collet.



Collet and Feeding Finger Adapters for Screw Machines

In the smaller sizes of machines—Nos. 2 and 0—the preferable way is to use a special chuck cap, with hole dimensions designed for the smaller machine collets, instead of the chuck cap adapter, which, however, is better for the Nos. 4 and 6 machines, because of the much smaller expense. Otherwise, the principle for all sizes of machines is the same.

In making the chuck sleeve, the two outside registering diameters of the sleeve should be held to within 0.00025 inch of the original machine chuck, because it is absolutely essential that this part fit snugly, yet with a free sliding fit, in the spindle. If it is slightly tight, the collet will not open, while any perceptible "shake" will cause chattering of the stock. Of the internal diameters, the tapered front part requires the greatest care. The angle on a side, in the later B. & S. machines measured by the writer, is within a few minutes of 14 degrees, but it will be best to verify this measurement, which can be easily done by placing the chuck sleeve in a lathe, truing it up, and measuring the difference in diameters by a dial test indicator, using a carriage stop and a size block slightly smaller than the length of the taper. It is important, of course, that the point of the indicator be strictly central, and in making the adapter sleeve later, it is essential that the boring tool point be strictly central.

The one other portion of the chuck sleeve that must be right as to location and diameter is that part of the hole where the rear-end registering surface of the collet will work, although up to 0.001 inch over-size will do no harm there. The adapter sleeve, in addition to its internal dimensions, differs from the standard in one more point, which is the addition of a spring chamber and coil spring directly back of the collet. This is necessary, because, otherwise, the smaller sized collet might not open against the heavier friction of the large chuck sleeve. The wire of which this spring is made should in all cases be slightly thicker than the wall thickness of the back end of the collet on the next smaller size of machine. In the case illustrated, it was made from 5/32-inch round drill rod. The coils should be separated by about their own thickness, and the spring made long enough to allow it to be given a good initial tension when in place, with enough action left to prevent it from ever being completely closed.

In regard to the feeding finger adapter *A*, little need be said, except that when everything is in place, it must bring the front end of the feeding finger to the same relative position lengthwise in the collet as it would in the machine to which it belongs. The feeding finger adapter should be made either from machine steel, and casehardened, or from tool steel and hardened and drawn to a spring temper. The chuck sleeve may be made from cold-rolled steel, and used soft, provided all bearing surfaces are carefully turned and smoothed. Made this way and used with reasonable care, it will give good service, though a hardened and ground sleeve is always better. The chuck cap adapter is best made from non-shrinking tool steel drawn at about 500 degrees F.

Adapters of this type need not necessarily be made for adapting one machine to the next smaller size; in some instances it will be desirable to make a set for a machine two sizes smaller. To give an instance: The No. 00 machine would ordinarily be the machine used to work 1/4-inch brass rod. A thread 2 1/2 inches long is to be cut on a 1/4-inch part. Neither the 00 nor the 0 machine will handle this work. By using a No. 2 machine with an adapter, many jobs of this kind can be handled with No. 00 feeding fingers and collets. However, a reduction from one machine to the next size will usually be most in demand.

Excessive length of a product to be made is a frequent cause of the inability of a small machine to handle a job within the range of its diameters, but the numerous instances where this occurs constitute by no means the only field of use for the adapter set. Often an article within the range of one machine must be made on a larger machine, because the machine on which it should be made is busy or laid up for repairs. Again, when a certain collet or feeding finger on a machine breaks or is otherwise damaged, it is often possible to substitute the same sized finger from a smaller machine, as in actual practice, the collet and finger equipment of different machines overlap to some extent.

* * *

Arc welding has been used at the several works of the General Electric Co. for a number of years in regular manufacturing practice with marked success. Its introduction has brought about a change in the design of many lines of apparatus, whereby arc-welded boiler plate has taken the place of cast iron. This practice has been of gradual growth. As far back as 1913, twelve arc welders were employed in welding thin sheet steel transformer tanks, 1/16 and 3/32 inch thick. Today the same plant uses fifty-seven arc welders on the same class of work. Each month these machines complete about 67,500 linear feet of welded seams.

Furnace Fuels and Oil Storage

By C. C. HERMANN, President, Hermann Associates, Inc., Engineers, Rock Island, Ill.

THE success of forging operations depends to a considerable extent on the method of heating the work. The form, size, and type of furnace vary for different classes of forge work, and although one form of furnace may be utilized for different classes of work, there are many operations that require a furnace of special design in order to obtain the best results. Many manufacturers do not realize the importance of correct furnace design. An instance illustrating this point came to the writer's attention a short time ago.

A manufacturer using a gas furnace that cost him eighty cents per hour for gas decided that he would change to fuel oil. The writer was called in to design a suitable furnace, but before the construction of the newly designed furnace was commenced, the manufacturer requested that the work be stopped; he had learned about a furnace in a nearby plant, and decided that he could have a similar one built for his own plant. It so happened that the writer had designed the furnace referred to, and being familiar with its construction, knew that it would not prove satisfactory for the different class of work required. After the difference in the two kinds of work had been pointed out, and the special requirements for each explained, the manufacturer realized the necessity for having a furnace specially designed for his own purposes, and permitted the work on the new design to be completed.

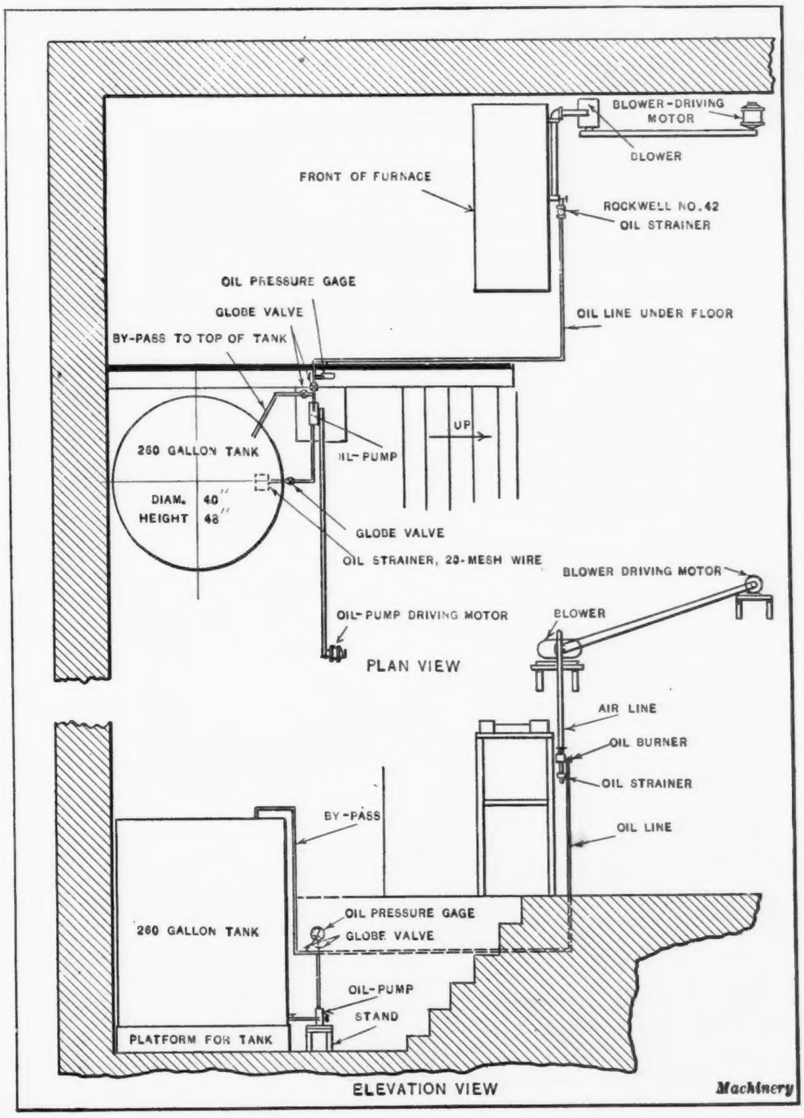


Fig. 1. Fuel Oil Storage and Piping System for Small Forging Plant

Mistakes such as might have happened in this case actually occur every day, and only after considerable money has been spent in building equipment that is entirely unsuitable for the work at hand is the error discovered. Even after it has been decided what type of furnace should be used, the problem of selecting suitable construction materials must be solved. This factor in furnace design is of considerable importance. The initial cost and the expense that may result from the necessity for making repairs must be considered.

The selection of a furnace for forge shop work depends upon the fuel available. There are several kinds of fuel that have been used quite extensively, namely, coal, coke, charcoal, gas, oil, and powdered coal. These fuels have been utilized successfully, and mark the changes in furnace design in about the order named.

Practically no coke furnaces are now in use in forge shops, a few being found in out of the way places where gas or oil fuel is not available. The principal disadvantages experienced with the coke furnace are the difficulty of obtaining accurate heat control, and of operating furnaces without a considerable amount of excess air coming into contact with the stock, which causes oxidation of the work and the emitting of a good deal of smoke and gas.

For the coal furnace, bituminous coal, free from sulphur and broken up into very small pieces, is preferable. Hard coal is rarely used, because of the impurities that it generally contains. A free-burning coal with a very low moisture content and little or no earthy matter is preferable. In determining upon the suitability of the coal for furnace heating, we must consider the fact that coke is formed when the volatile matter has been driven off. Very little ash should be formed, and less than 1 per cent of sulphur should be contained in the coal. Coke consists of fixed carbon and ash, the fixed carbon being that part of the fuel available for producing heat.

Coke is available in two grades. One grade is the product of gas retorts, and the other is produced in the bee-hive oven. When coke is produced by the latter method, about 35 per cent of the weight of the coal passes off as vapor. One characteristic of coke is that practically all the sulphur contained in the coal is retained in the coke, making it necessary to use low-sulphur coal for this purpose. Charcoal is a solid fuel produced by artificial means, and contains but very small quantities of sulphur or other objectionable matter. This feature makes it ideal for heating steel, the only drawback being that the temperature obtained is moderate, yet sufficient to heat everything except high-speed steel.

Gas is quite extensively used as a forge shop fuel. Four kinds are generally available, and the selection will depend upon local conditions. Natural gas is quite abundant in some

sections of the United States and Canada, and is a desirable fuel. The chief objection to this fuel is that it contains sulphur, which may cause trouble when the work is heated by direct contact with the flame. Illuminating gas is extensively used throughout the country for forge furnace work. Producer and water gas are also used.

Probably the most commonly used fuel for forge furnaces is fuel oil. Like natural gas, it is obtained from wells in certain localities, and its economical use will depend upon the distance that the oil must be transported. In its crude state, it contains lighter oils which are separated by distillation. Some of these oils are naphtha, gasoline, and kerosene. The specific gravity of the fuel should be from 24 to 30 Baumé. It is possible to use a heavier oil where facilities for heating it are provided, in order to keep the oil in a sufficiently fluid state to permit it to flow freely in the pipe lines and through the small port of the burner. This necessitates running steam pipes parallel with and close to the oil-pipes. This practice is advisable even when the lighter oils are used.

The fuel should possess a heat value of not less than 18,000 British thermal units per pound. It should not contain more than 1 per cent sulphur, nor more than 2 per cent oil. Just a trace of sand and other foreign matter is ordinarily permissible. The flash point should not be lower than 140 degrees F. when tested in a closed type of tester. The latter requirement is of considerable importance, as large quantities of oil must be kept in storage. While gas is generally stored in large central tanks that supply a certain district, fuel oil requires individual storage equipment. Pipe lines through which the oil may be pumped under pressure, and means for raising the temperature of the oil must also be provided.

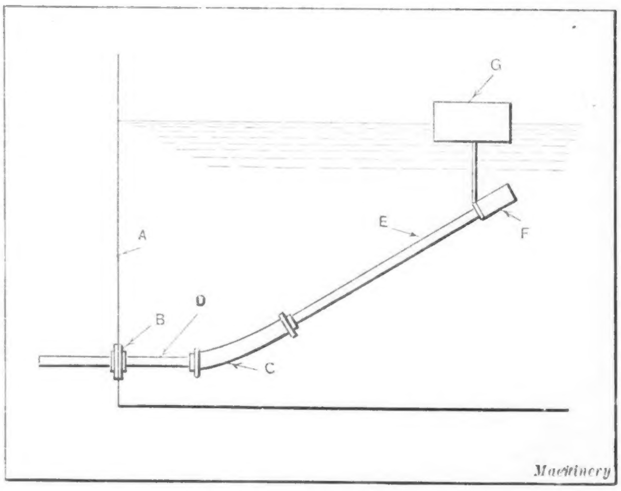


Fig. 2. Intake Pipe in Fuel Tank

Fuel Oil System for a Small Plant

In Fig. 1 is shown a fuel oil storage and piping system for a small plant. This system is designed to meet the requirements of two medium sized furnaces. In some districts, fuel oil is carried by local supply companies, thus making it possible to obtain the fuel in small quantities. In the installation shown, the storage tank is of 260 gallons capacity. As the entire installation is within the forge shop building, no extra provision need be made for heating the oil in the tank or pipe lines. The storage tank, in this case, is installed in a room, the lower level of which is somewhat below that of the furnace room. The highest point of the tank is, therefore, kept below the furnace burner level. This is desirable, and in fact, it is considered good practice to have the tank below the main piping level, so that should a leak occur in the pipe, the fuel will not drain out into the shop.

The oil-pump is installed near the tank in order to provide sufficient pipe capacity between the pump and burner to make it unnecessary to install a cushion tank. The object of the cushion effect is to smooth out the pulsations of the pump which cause the burner to operate erratically, and to obtain a steady flow of oil at the burner. Whenever possible, a pump should be used that will give a steady stream of oil without pulsations. For this reason, a piston pump is seldom used for oil systems, and would be satisfactory only when a good sized tank is incorporated in the system between the pump and the burner. Such tanks frequently become airbound and thus prove a source of annoyance. This trouble may be eliminated to a certain extent by supplying the tank with an air relief. Centrifugal or rotary pumps are widely used in oil distributing systems, and in general, they give good results.

Oil-pipe Intakes

The oil intake pipe within the storage tank must be provided with a strainer in order to exclude all solid matter which might enter the pipe and render the system inoperative. The strainer need be nothing more than a closed-end wire screen cylinder a few inches long. In large installations, the intake is preferably made flexible, so that it is kept near the surface of the oil. Two distinct advantages are thus obtained—the warmer oil, which is always near the surface, is drawn into the pipe, and the water which separates from the oil and settles to the bottom is kept out of the pipe system. A type of intake that has given good results is shown in Fig. 2.

Referring to this illustration, a section of the tank is shown at *A* with the pipe connected at *B*. A short piece of flexible hose *C* is attached to the pipe projection *D* and the piece of pipe *E*. On the end of pipe *E* is attached the strainer *F*, which is held up near the surface of the oil by the float *G*. This arrangement keeps the suction inlet away from the water and heavier oil which settles to the bottom of the

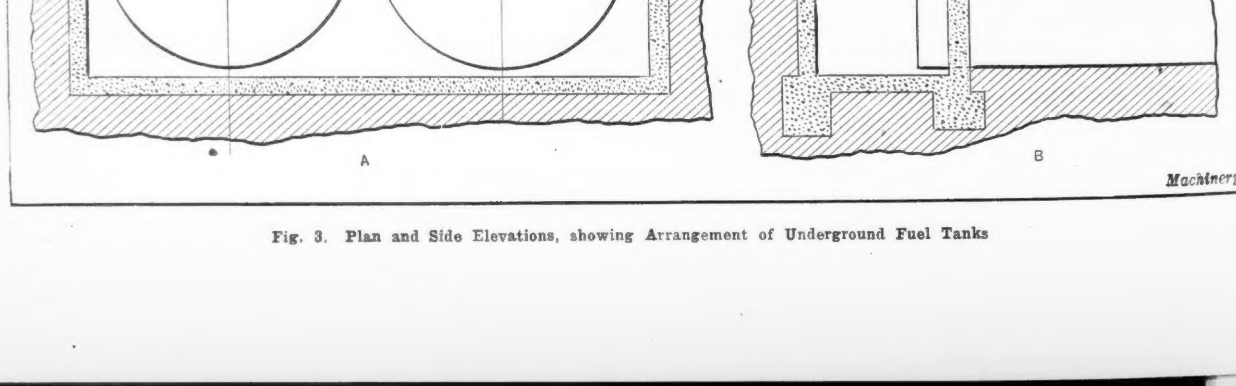


Fig. 3. Plan and Side Elevations, showing Arrangement of Underground Fuel Tanks

tank. The water and heavy residue is removed by an auxiliary pump and by cleaning the tank at intervals.

Referring to Fig. 1, it will be noted that a globe valve is inserted in the suction line between the pump and tank to facilitate repair work on the pump. It is preferable to drive the pump by belt, as a positive drive is likely to cause damage to the pump or some part of the equipment, in case the pipe line becomes clogged or the oil pressure becomes excessive from any other cause. In such cases, the belt will slip or run off the pulley without causing any damage to the system. The pump should be located above the level of the tank floor, where the belt can be more easily protected from grease and oil.

Oil Pressure Control

An oil-pressure gage is an important item of the oil distributing system. Ordinarily, from 30 to 40 pounds pressure is required to overcome the pipe friction and project the oil into the furnace with sufficient force to maintain effective atomization. The pressure must be kept fairly constant throughout the operating period, a requirement which makes an oil-pressure regulator a desirable piece of equipment. The regulator may, however, be dispensed with by incorporating a relief valve in the system and piping the overflow back into the tank. The valve is set to obtain the desired pressure on the distributing line. The writer has operated such systems by means of a globe valve and by-pass installed as indicated in Fig. 1. The valve is cracked open just enough to keep the right amount of pressure on the distributing line, and the by-pass carries the surplus oil back to the tank.

Considerable trouble results from having the oil distributing pipes out in the open. When placed outdoors or along the walls of the building, and in some cases near the ceiling, the oil becomes cold, so that it flows slowly even under high pressure. It is preferable to have the distributing lines placed beneath the floor in tunnels. If this cannot be done, the pipes should at least be covered with a good heat-insulating material. It is good practice to have the oil lines run parallel with a steam line and have the two lines wrapped together. This tends to keep the oil warm and in a fluid state. At the furnace end of the piping system and close to the burner is located an oil strainer. This strainer requires frequent cleaning and should, therefore, be so designed that it can be removed without disconnecting any more piping than necessary.

Atomizing System

The atomizing agent, whether it be air or steam, should be piped directly to the furnace with as few bends in the pipe as possible. This is particularly important when air is used. Air piping should be provided with long-sweep ells, and a valve or blast gate should be installed at each furnace to provide for stopping the air blast when the furnace is shut down. The air requirements vary with different burners, and should be considered in connection with the type of burner employed. However, it may be said that practice seems to favor the low-pressure type of air burner. Air at a pressure of about one pound for atomization purposes, and in some instances, heated prior to its injection into the furnace, is being used very successfully.

For welding furnaces, a somewhat higher air pressure is required. When the air pressure is around one pound, the positive-pressure rotary blower can be used. Centrifugal blowers are also used extensively for such service. The latter are sometimes criticized because of the vibration they set up in the furnace and combustion chamber. This trouble can be lessened or eliminated by providing a suitable amount of pipe capacity between the furnace and the blower. In some cases, this vibration can be eliminated by extending a short air pipe above the discharge of the blower and bringing this pipe to a dead end so that it will act as a reservoir.

The size of the burners depends upon the size of the furnace combustion chamber and the work required of the furnace. In some instances, it is preferable to use two small burners instead of a single larger one, chiefly for the reason that greater flexibility and more even distribution of the heat to all parts of the furnace is obtained.

Oil Storage Tanks

The storage tank capacity is determined by such factors as the present and estimated future consumption, the relative distance from distribution points, and the probable market conditions. Few plants find it advisable to provide storage for less than a ninety-day supply, and in few cases is the storage capacity less than 10,000 gallons, which is sufficient to hold a tank car of oil with an allowance which permits the unloading of a car before the old supply is entirely consumed. It is advisable to have two tanks, so that one may be cleaned while the other is in use, and also to provide for unloading tank cars that arrive unexpectedly. When the tank capacity is large, there is a better opportunity to take advantage of changes in the price of oil.

Large tanks call for a somewhat different installation from that shown in Fig. 1. In Fig. 3, is shown an installation of two tanks that works out advantageously. At *A* is shown an end elevation, and at *B* a partial side elevation of the tanks. The tanks are placed underground with the manhole *C* projecting through the surface. Fumes are constantly arising from the oil, and it is advisable to allow these to escape freely to the atmosphere. The front ends of the tanks project into a concrete pit *D*, a feature which facilitates making the pipe connections and provides a place for the oil-pump. The remainder of the tank is buried directly in the ground, with clean sand placed around the tank shell. If the ground contains considerable water during certain parts of the year, it will be necessary to anchor the tanks down in order to prevent them from rising should the oil level in the tanks become so low that their buoyancy will cause them to rise. In some instances, it may be advisable to provide a waterproof pit for the entire tank.

If possible, elevated tanks should be avoided, for if a leak should occur in the pipe line, the oil supply would drain into the shop, thus causing a serious fire hazard. The installation of oil tanks in many states is governed by law, and all installations must meet with certain insurance rules and regulations. The underground tank is generally conceded to be the most practical when moderate quantities of oil are consumed. When the storage runs up into the hundred thousands of gallons, other considerations must, of course, govern the installation.

* * *

MACHINERY EXHIBITS AT SESQUICENTENNIAL INTERNATIONAL EXPOSITION

One of the features of the sesquicentennial international exposition, celebrating the 150th anniversary of the signing of the Declaration of Independence, which will be held in Philadelphia from June 1 to December 1 will be the machinery exhibits. These exhibits are to be housed in a building especially erected for the purpose which will be known as the Machinery, Engineering, Mines, Metallurgy, and Transportation Palace. They will include Diesel engines, ice-making and refrigerating machines, boiler and mechanical stokers, transmission machinery and equipment, paper-making and rubber mill machinery, steam specialties, hydraulic machinery and equipment, electrical machinery, oil-well machinery, mining and conveying machinery, and transportation equipment, including locomotives, motor buses and trucks, steamships and motorboats, and all types of ship machinery.

* * *

The competition with motor buses is forcing the railroads to adopt new means of transportation on lines where passenger traffic is not heavy enough to warrant the frequent running of steam trains. The Boston & Maine Railroad is installing a great number of motor rail cars and auxiliary coaches, having ordered equipment of this kind to a value of about $500,000.

Dies for Steering-wheel Spiders

Construction of Dies Used in Stamping the Arms of Steering-wheel Spiders and in Assembling them to the Hub—Second of Two Articles

By JAMES M. ACKLIN, Vice-President and General Manager, The Acklin Stamping Co., Toledo, Ohio

SIX dies used in the plant of the Acklin Stamping Co., Toledo, Ohio, for producing the hub of a steel automobile steering-wheel spider were described in an article published in December MACHINERY. The present article will deal with the dies used to make the arms for the spider and assemble them to the hub. A continuous type of machine employed for casting a white alloy center in the hub will also be described. The design of the steering wheel was illustrated in the preceding article.

Blanking and Piercing Dies

The first operation on an arm, which consists of cutting the blank to the irregular outline *X*, Fig. 1, is performed by means of the die shown in the same illustration. The blank is approximately 7 1/2 inches long by 3 1/4 inches wide at the maximum point. As the part is tapered, sufficient space is left between the blanks to permit of reversing the stock after one pass through the die, and cutting blanks from the stock left between the openings in the first pass. A large saving in stock has been effected by this method. The stock is guided through the die by blocks *A* and is blanked as punch *B* enters die *C* on the downward stroke of the press ram. Each blank falls through the die-block to a receptacle beneath the bed of the press. Die *C* is made in four sections.

In the next operation, which is performed by means of the die shown in Fig. 2, slot *X* is pierced by punch *A*, hole *Y* by punch *B*, and four notches *Z* by punches *C*. Notches *Z* form round holes when the arm has been shaped to the final form, through which excess enamel drains when the arm is given an enamel finish. Each punch enters a die ring, such as illustrated at *D* and *E*. Plates *F* and *G* strip the blank from the punch on the upward stroke of the ram.

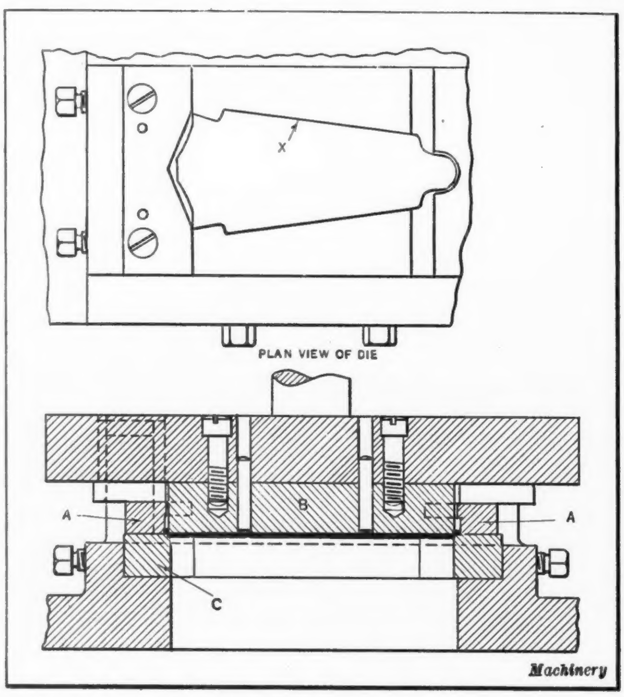


Fig. 1. Die used to produce the Blank from which the Steering Spider Arms are formed

Forming the Arm into a Box Section

Two dies of unusual design are employed to form the arm into a box section. The die shown in Fig. 3 bends it into the channel shape indicated by the heavy solid lines and dotted lines *X*. The forming is accomplished as punch *A* enters die *B* and bends the blank between the walls of the punch and die. Pressure is exerted on the work by die-block *C* so that it is held firmly against the lower face of the punch during the operation. This pressure is derived from a spring buffer which actuates pins *D*. Die *B* is made in four sections, as may be seen in the plan view.

At the right-hand end of the die, there is a block *E* which is held stationary on the die-shoe. In this block is a small plug which is adjustable vertically by means of screw *F*. Attached to punch *A* directly above block *E* is a block *G* in which there is a small punch that mates with the plug in block *E*. Block *G* with its punch and block *E* with its plug form the end of the arm that is attached to the wooden rim when the steering wheel is assembled. Blocks in front and in back of the die opening locate the blank for the operation.

Closing the arm into the box section is completed by means of the die illustrated

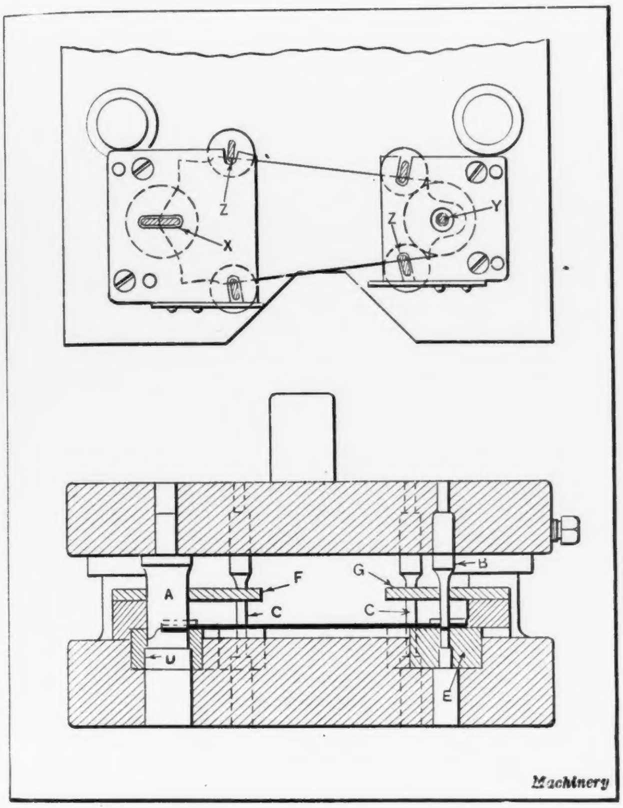


Fig. 2. Die Equipment used for cutting Five Notches and a Hole in the Arm Blank

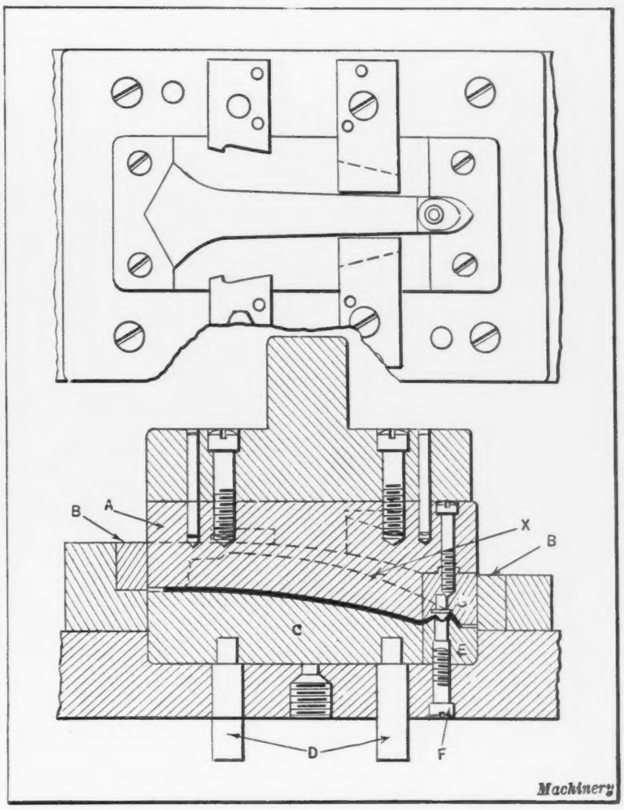


Fig. 3. Die for forming the Arm into a Channel Section and for partly shaping One End

in Fig. 6. For this operation, the stamping is laid in die-block *A*, and then arbor *B* is projected over it by seating the horn in bracket *C*. On the downward stroke of the press ram, punch *D* closes the channel sides of the arm on top of the arbor, as shown in the sectional view at the right-hand side of the illustration. From this sectional view it will also be seen that punch *D* is made in two parts which are spread out on their inner side so that they can be lowered readily over the work. When the operation has been finished, arbor *B* is lifted with the work from bracket *C* in order to permit the finished arm to be slipped from the horn. Two sets of dies are next employed to clinch four arms to each hub. The first of these sets is shown in Fig. 4. A hub with four arms loosely assembled is placed on die-block *A*, which is cut away as illustrated in the plan view to accommodate the arms. Then on the downward stroke of the ram, punch *B* bends down the upper edge of each arm over the upturned flange edges of the hub, locking the arms securely on the hub. A knock-out pad *C* is provided to eject the work from the punch, and guide posts keep the punch and die members aligned. Hubs are delivered to the press in which this operation is performed, with the arms loosely assembled on them, so that the operation of the machine is delayed as little as possible.

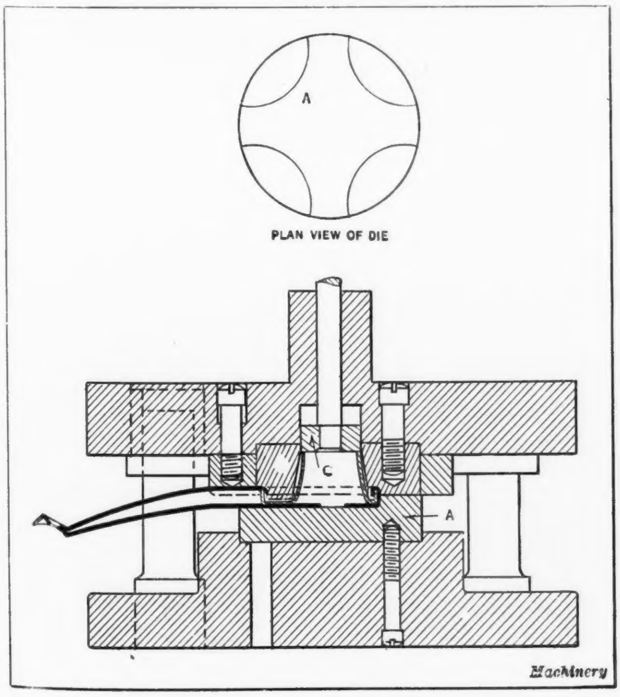


Fig. 4. Die Set by Means of which the Four Arms are partly assembled to the Hub

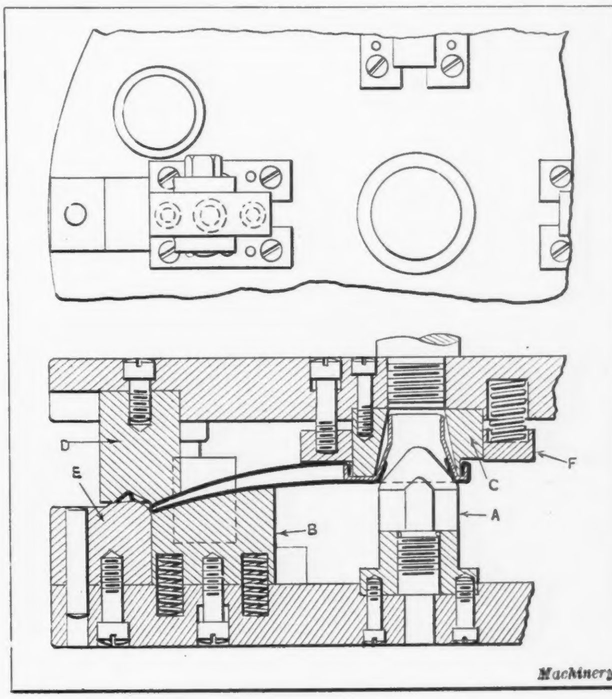


Fig. 5. Second Die by Means of which the Assembling of the Arms to the Hub is completed

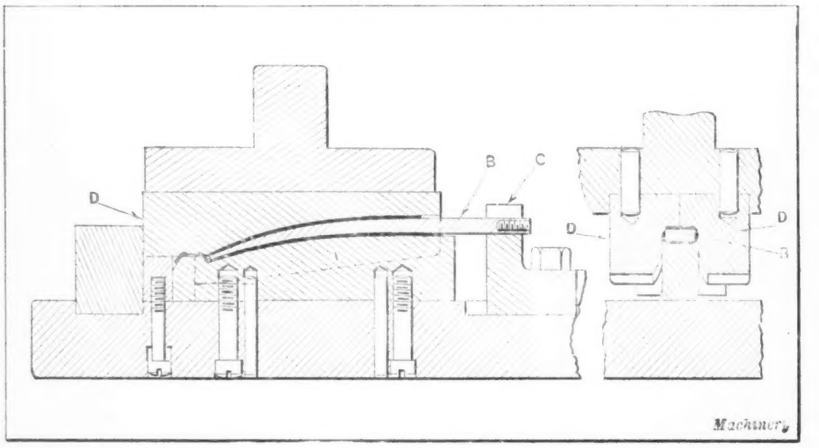


Fig. 6. Punch and Die of Unusual Design used for closing the Arm into a Box Section

In the second assembling operation, the bottom inner edge of each arm is bent against the inside of the hub proper, and the outer end of each arm is bent back, as illustrated in Fig. 5. The outer end of the arms is later fastened by wood screws to the wooden steering wheel, and is not finish-shaped until this time, so as to insure uniformity in the different arms and facilitate assembling the wheels. For this operation, the hub is seated on die plug *A*, with the outer end of each arm lying on a block *B* which occupies a raised position at the beginning of an operation due to the action of two coil springs located beneath it. On the downward stroke of the press ram, the bottom inner edge of the arms is forced against the inside of the hub, as mentioned, when punch *C* pushes the work down on plug *A*. Simultaneously, the outer end of each arm is bent back as punch *D* forces it on die-block *E*. Stripper plate *F* is actuated by coil springs to eject the work from the punch on the return stroke of the ram. Guide posts are also furnished for this set of dies. This operation is the last one performed on power presses, the next step being the casting of the hub center; the alloy used and the equipment employed in casting the center will be described in the following.

The alloy center is cast in the hub, as mentioned in the previous article, to form a rigid bearing for the steering rod of the automobile. This alloy is a composition of aluminum, copper, and zinc. It is not important that the alloy be especially strong, because the hub stamping gives the necessary strength to the spider, but the alloy should be hard enough to obviate crushing when the nut and washer of the steering rod are clamped on it. The casting machine, which is shown in the heading illustration, consists of a continuously rotating table, 6 feet in diameter, on which are mounted five casting units such as illustrated in Fig. 7. A small motor running at 700 revolutions per minute drives this table through reduction gears at a speed of one revolution per minute; hence the production of the machine is five steering-wheel spiders per minute.

The hub stamping, with the spider arms extending radially, is seated in ring *A* when housing *B* containing the mold, is swung upward on pivot *C* and arbor *D* is lowered from the position shown. Housing *B* is raised and lowered by handle *E*. After the work is in place, the hinged housing is lowered into the position shown, lever *F* which swings on links *G* is lifted on pad *H* to lock housing *B* in place, and lever *J* is operated to raise arbor *D* as illustrated, through the medium of link *K* which engages a pin in part *L*.

Molten metal is then poured by one man into the permanent mold *M*, from which it drains through holes in gate plate *N* into the space between the hub stamping and arbor *D*. By the time the mold has been carried to another man on the opposite side of the machine, the casting has solidified sufficiently to permit it to be removed. There are several holes in the hub in which the metal solidifies and anchors itself firmly. The man at the reloading position pushes down on handle *E* to raise the pot assembly slightly and thus break the joint of the work with the under side of the gate plate. He then raises housing *B*, quickly removes the spider by grasping one of the arms, cleans the excess metal from the mold, and lays a new spider in place. The other workman closes the mold, pours the metal and tends to the melting pot.

These molding units are designed to permit the quick replacement of parts that become distorted from the heat or worn. Parts can be conveniently replaced while the machine is in motion so as not to interfere with production any more than is necessary. Each entire unit swings about a pivot near stud *O* to facilitate repairs. The large taper hole produced in the alloy casting by arbor *D* is later finished accurately in a reaming operation, and a keyway is broached in this hole. The top of the center is faced in a lathe.

* * *

According to a chart prepared by the Industrial Machinery Division of the Department of Commerce and recently published in *Commerce Reports*, 6.9 per cent of the production of American metal-working machines in 1923 was exported.

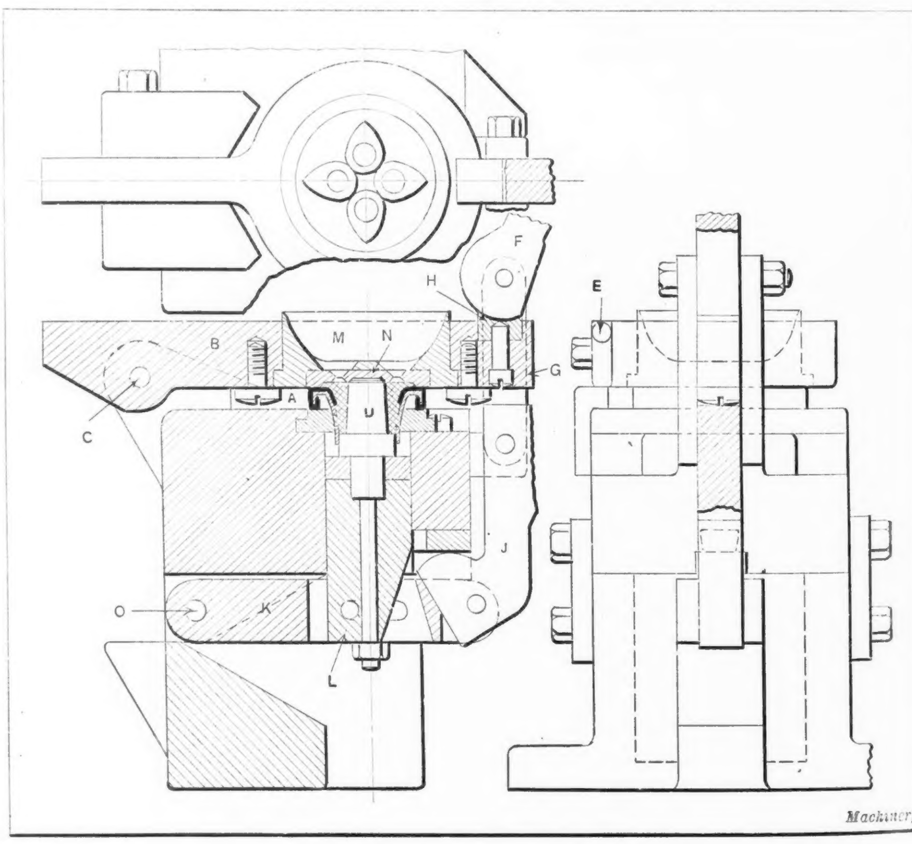


Fig. 7. One of Five Molding Units mounted on a Continuously Rotating Table for casting the Alloy Center in the Hub

GRINDING SOFT METALS

By C. C. H.

The grinding of soft metals, such as copper, aluminum, monel metal, duralumin, babbitt metal, or lead, presents greater difficulties than the grinding of harder metals. The soft metals cling to the abrasive and fill up the cavities between the grains. The abrasive surface thus becomes smooth, the grinding action of the wheel ceases, and the work heats up. The filling up or glazing of the wheel is commonly known as "loading" or "gumming." Another cause of glazing is the dulling of the abrasive. This condition is eliminated by dressing the wheel. Of course, the dressing process causes the wheel to be worn down rapidly, and the production per wheel is often unnecessarily cut down by frequent dressing. The correct procedure is to prevent the wheel from loading.

Preventing Wheel from Loading

The tendency of a grinding wheel to become loaded may be eliminated or lessened by rubbing tallow or paraffin over the cutting surface of the wheel. The method of applying this lubricant varies with the type of wheel used. Paraffin can often be applied satisfactorily to cylindrical grinding wheels by holding the bar of paraffin against the wheel while it is in motion. In the case of disk grinders, it is better to apply the paraffin before the machine is set in motion. The bar is rubbed over the surface of the wheel, thus filling the cavities between the abrasive and preventing the soft metal from sticking to the disk.

In the case of cylindrical grinding wheels, water may be used in place of paraffin or other lubricants. It is the function of the water to carry away the heat generated by the grinding operation. In using water, however, an additional process is necessary in order to reclaim the soft metal grindings, and the water must contain alkali to prevent rusting. Where the grinding disk is employed, water cannot be used, as it will soften the back of the disk and cause it to become loosened from the plate to which it is cemented. Tallow or paraffin must therefore be used on grinding disks.

Grain Used for Soft Metal Grinding

It is considered necessary, from an economical standpoint, to employ wheels with as coarse a grain as it is possible to use and still obtain the desired finish. In the selection of the grain, one is often misled by the deeper scratches produced in the first few pieces ground. After a few pieces have been ground, the abrasive wears off, and a finer finish is produced on the work. The smoother finish is obtained, however, at the expense of lowered production. This factor should be taken into consideration, and if slightly deeper scratches are permissible for, say, a few pieces, the coarser wheel should be given preference in order to obtain increased efficiency. The selection of the grade of wheel also materially affects the glazing of the cutting surface. In general, the coarser grains should be used with softer materials.

Using Proper Wheel Speeds

To a certain extent, the cutting action of the abrasive may be compared with that of a milling cutter. On hard materials having a high percentage of carbon, the wheel must be operated at a lower speed than on soft steel, particularly such soft metals as referred to in this article. In general, the softer the metal, the higher may be the speed of the wheel. The high speed reduces, to a considerable extent, the tendency of the wheel to load. In cases where the work revolves during the grinding operation, the speed of the work must be taken into consideration. For example, if the work is revolved at too high a speed, while the wheel runs at the proper speed, the stress on the cutting grains of the wheel caused by the pressure of the work will be materially increased and may tear the grains from the surface of the wheel and decrease the production per wheel.

If the wheel is operating at too high a speed and the work is revolving at the proper speed, glazing will take place rapidly. Again, with the wheel operating at the proper speed and the work at too low a speed, the abrasive will soon be dulled, thus necessitating frequent dressing of the wheel surface. This happens because there is not sufficient action between the work and the wheel to remove the dulled abrasive particles or break them up so that they will present new cutting points. Obviously, production is materially reduced under these conditions.

Grades of Wheel

When a wheel of the most desirable grade for a particular job is not obtainable, a less desirable wheel can sometimes be used with good results if it is run at the proper speed. For example, a soft wheel may be made to act more like a hard one by increasing its speed. A coarse-grain wheel will produce a reasonably smooth surface by increasing its speed, so long as none of the undesirable conditions described are experienced.

Use of Abrasive Disks

The determination of the proper speed is an important consideration in the use of abrasive disks for grinding soft materials. A variable speed within certain limits may be obtained by applying the work at different radial distances from the center of the disk. Maximum production per disk cannot be obtained, however, when this method is employed, as the wheel is worn away only at certain points. It is advisable, in order to obtain maximum production per disk, to provide the machine or drive with a variable-speed mechanism.

Obtaining a Fine Finish

It may appear at first that a fine-grained wheel must be used to obtain a fine finish. However, if the wheel has been properly trued and the speed of the wheel and work and the depth of cut are correct, a coarse-grain wheel may be used. For the roughing cuts, the wheel will remove a good deal of metal, and the abrasive marks may appear very deep in the surface of the work. Chatter marks may also be noticed, but these need not be considered seriously if the finishing operation is properly conducted. Following the roughing operation, the wheel must be trued or dressed. If there is no vibration in the machine, a smooth finish will be produced when this procedure is followed.

Detrimental Effect of Vibration

Vibration is especially troublesome when grinding soft metals. The soft materials do not have sufficient hardness or resistance to prevent the depth of the cut from varying as the pressure between the wheel and the work is changed by vibration. This produces a wavy finish. In grinding long pieces, the deflection due to pressure of the wheeel is considerable, and the least vibration of the arbor and wheel results in inaccuracies and a poor finish. The application of a follow-rest will, of course, prevent the work from being deflected. The vibration of the machine must be eliminated by refitting the bearings and properly balancing the rotating members. Vibration and end play in disk grinders will cause the disk to pound against the work with sledge hammer effects, thus loosening the abrasive and causing the disk to wear out quickly.

* * *

THE TRAINING OF FOREMEN

The experiences of more than one hundred manufacturers who have conducted courses in foremanship training in their plants are summarized in a pamphlet entitled "Foremanship," just issued by the Chamber of Commerce of the United States. The summary deals with training methods used in almost every branch of industry. No one particular system or plan is advocated, the aim being to place on record what has been accomplished through the methods described. A copy of the pamphlet may be obtained by addressing the Department of Manufactures, Chamber of Commerce of the United States, Washington, D. C.

DRILLING TANK OR BOILER PLATES

ROSCOE A. AMMON, Latrobe Tool Co., Latrobe, Pa.

Where there are a number of duplicate plates, it is cheaper to drill than to punch the holes. The assembly cost will also be lower when the holes are drilled, because they will match up better. A safe rule to follow when stacking plates for drilling is to have the total thickness of the stack not more than four times the drill diameter for holes up to 7/8 inch in diameter, and five to six times the diameter for larger drills. Seven 1/2-inch plates having a total thickness of 3 1/2 inches is about right for a 13/16-inch drill, although if the plates are bolted tightly together and there is no backlash in the feeding and driving mechanism of the drilling machine, ten 1/2-inch plates can be drilled successfully with a 13/16-inch drill. The chips can be raised as easily from the 5-inch depth as from the 3 1/2-inch depth, and the drills can be cooled all the way to the bottom of the hole with water. A 1 1/2-inch drill will work satisfactorily on stacked plates having a total thickness of 9 inches if the feed is heavy enough to keep the chips from choking in the hole.

Drill Jigs

The thinner the jig can be made, the better, as the distance the chips must be raised will be less and the water will not need to go down so deep. There will be no danger of the drill "walking" if the work is held securely, the drilling machine is rigid, and the drill properly ground. If the drilling is done from center-punch marks, the marks should be made very full. A little extra time in properly center-punching will result in better holes at a lower cost. In some shops, a portable electric drill with about a 3/16-inch drill is used to spot the holes after prick-punching. This method requires less time and gives better results than are obtained by center-punching. For very accurate work, such as tube sheets, a combination drill and countersink is used to center the holes to be drilled.

Coolant for Drilling

There should be a steady flow of coolant from a pipe of suitable size. Plain water is satisfactory, as the cooling action is the main factor. A compound is better, of course, but it is expensive if used as copiously as it should be. The coolant pipe should not be less than 1/2 inch in diameter, a large volume of the coolant being more desirable than a small volume at high pressure. The coolant should be directed into the hole being drilled, and should not be splashed over the work and the machine. The writer prefers coolant piping larger than 1/2 inch if there is a return tank. The usual practice of spilling a little compound on the work from a can will not do if the drills are taking a real cut. Drills will be burned in ten seconds if run at proper feeds and speeds without a coolant.

Speeds and Feeds

A peripheral speed of 65 feet per minute may be considered safe. Nearly all drill catalogues recommend a higher speed, but unless the plates and the drill press are exceptionally rigid, it is not practical to use much higher speeds. Better results will be obtained by using a lower speed and a higher feed than most drill makers recommend. This method of operating a drill will prevent the corners of the cutting lips from being burned and dulled quickly. If the drill is properly ground and the work rigidly secured, the drill will produce more holes per hour and more holes per drill with heavy feeds than with high speeds. The idea is to make the drills take a real cut or bite. The values in Table 1 are calculated on a basis of a surface speed of about 65 feet per minute at the periphery of the drill, and the writer believes that the speeds and feeds given in this table will give the best results.

TABLE 1. SPEEDS AND FEEDS FOR DRILLING STEEL PLATE

Size of Drill	Speed, Revolutions per Minute	Feed per Revolution, Inch		Approximate Penetration per Minute, Inches	
		Min.	Max.	Min.	Max.
9/16	440	0.010	0.014	4 1/2	6
11/16	360	0.012	0.016	4 1/4	5 3/4
13/16	300	0.014	0.018	4 1/4	5 1/4
15/16	265	0.014	0.020	3 3/4	5 1/4
1 1/16	230	0.018	0.024	4	5 1/2
1 3/16	205	0.018	0.024	3 1/2	5 1/4
1 5/16	190	0.020	0.031	3 3/4	5 3/4
1 7/16	170	0.020	0.031	3 1/2	5 1/4
1 9/16	160	0.020	0.031	3 1/2	5

Machinery

TABLE 2. PRODUCTION RATES FOR STEEL PLATE DRILLING

Size of Drill	Total Thickness of Stacked Plates, Inches	Number of Plates In Stack	Thickness of Each Plate, Inches	Number of Holes Drilled through Stack in 8 Hours	Total Number of Holes Produced in Plates in 8 Hours
17/32	2	8	1/4	1080	8640
13/16	3 1/2	7	1/2	688	4816
1 1/16	4 3/8	5	7/8	472	2360
1 5/8	7 1/2	7	1 1/16	185	1295
1 3/4	9	6	1 1/2	136	816

Machinery

Tightening the Clamping Bolts

It is essential that the plates to be drilled be rigidly clamped or bolted together. Any weaving of the plates will result in wearing off the cutting corners of the drills. In most shops, it is the practice to put in extra bolts in the plates as the drilling operations proceed and also tighten the bolts that have already been used. After drilling a few holes near a bolt, it is usually possible to give the nut a half turn, thus bringing the plates together so that they become more like a solid piece of steel. Some production speeds that have been maintained for a period of at least one day are given in Table 2. It should be borne in mind that these rates were obtained in a shop that had been equipped to drill holes as cheaply as possible and that an effort was made to have none of the details neglected.

Equipment Required

Radial drilling machines employed for plate drilling should have an automatic column clamp that is within easy reach of the operator. This clamp should be employed to lock the machine members securely before drilling, as it is impossible to use heavy feeds if the column is not securely clamped in place. It is the practice of many operators to have the clamping tension on the column arm light enough to permit pushing the arm around and yet be sufficiently tight to permit drilling without tightening the clamp. This is poor practice, and is employed in order to avoid the necessity of walking around the machine to tighten the clamp. If an electric or air locking mechanism handle is located in a convenient position, the operator will tighten it as soon as the point of the drill enters the center-punch mark.

When the column is locked after the spindle has been pushed upward through contact with the work, an undue strain is placed on the drilling machine and the drill. The writer believes that the day is not far off when a radial drilling machine will be considered out of date if it is not provided with an automatic column clamp.

It should be borne in mind that heavy cuts cannot be taken unless the drill is properly sharpened. A separate emery wheel should be provided for drill grinding only. It is practically impossible to grind a drill correctly on a wheel that is used for miscellaneous grinding. It is the writer's experience that when the right drilling equipment and methods are employed, it is less expensive to drill steel plates than to punch them.

Design of Lathe Tailstocks

Typical Designs for Different Classes of Machines—First of Three Articles

By FRED HORNER

ALTHOUGH a lathe tailstock is intended primarily to hold the dead center in alignment with the live center of the headstock spindle, it is made to serve many other purposes by providing suitable tools and attachments. Screw- or lever-actuated devices are often employed on tailstocks to control the feeding movements of special tools. In some cases, detachable tool-holders are applied to the tailstock for performing drilling or boring operations that require power feeds.

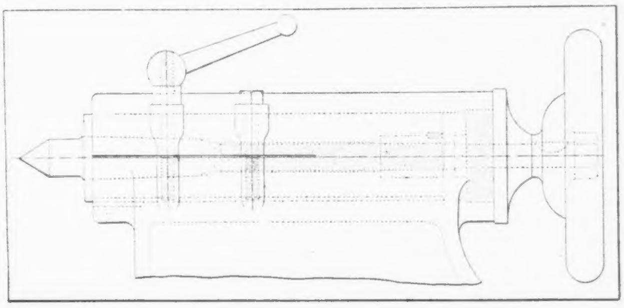


Fig. 1. Tailstock employed on 27-inch Lathe

The problem of maintaining accurate alignment of the lathe spindle, tailstock, and lathe bed has resulted in the development of lathe beds of different forms or types. In some designs, the tailstock is kept in alignment by the ways, between which it is carefully fitted, while in other designs, the back edge or the inner edge of one of the lathe ways serves as a guide, the object in this case being to have a guiding surface that will not be affected by the wear of the bearing surfaces of the carriage.

Simple Types of Tailstocks

The simplest tailstock is one that has no spindle or barrel movement, the spindle being fixed in the body of the casting. This type is used in axle-turning lathes. A slight improvement over this design consists of a block bolted to the lathe bed and a pointed screw threaded to fit a tapped hole in the block. The pointed screw is located in line with the live center of the headstock spindle, and serves as the dead center. A simple handwheel or lever may be employed to adjust the pointed screw as desired. Such a primitive arrangement is suitable for wood-turning on small lathes. A similar but improved design with an inserted center is used on lathes employed in mechanical training schools.

The unprotected threads of a simple pointed screw and the errors in alignment to which centers of this kind are subject have led to the general adoption of plain spindles provided with concealed actuating screws. A small tailstock with an arrangement of this kind is shown in Fig. 3. This design is used on the Pratt & Whitney bench lathe. The screw is made long enough to permit it to be used for ejecting the dead center by running the spindle back. A short nut is pinned to the end of the spindle, and the bearing bushing at the end of the casting is held in a fixed position by a cross-pin. A split lug at the front end of the tailstock casting is provided to permit locking the spindle in place.

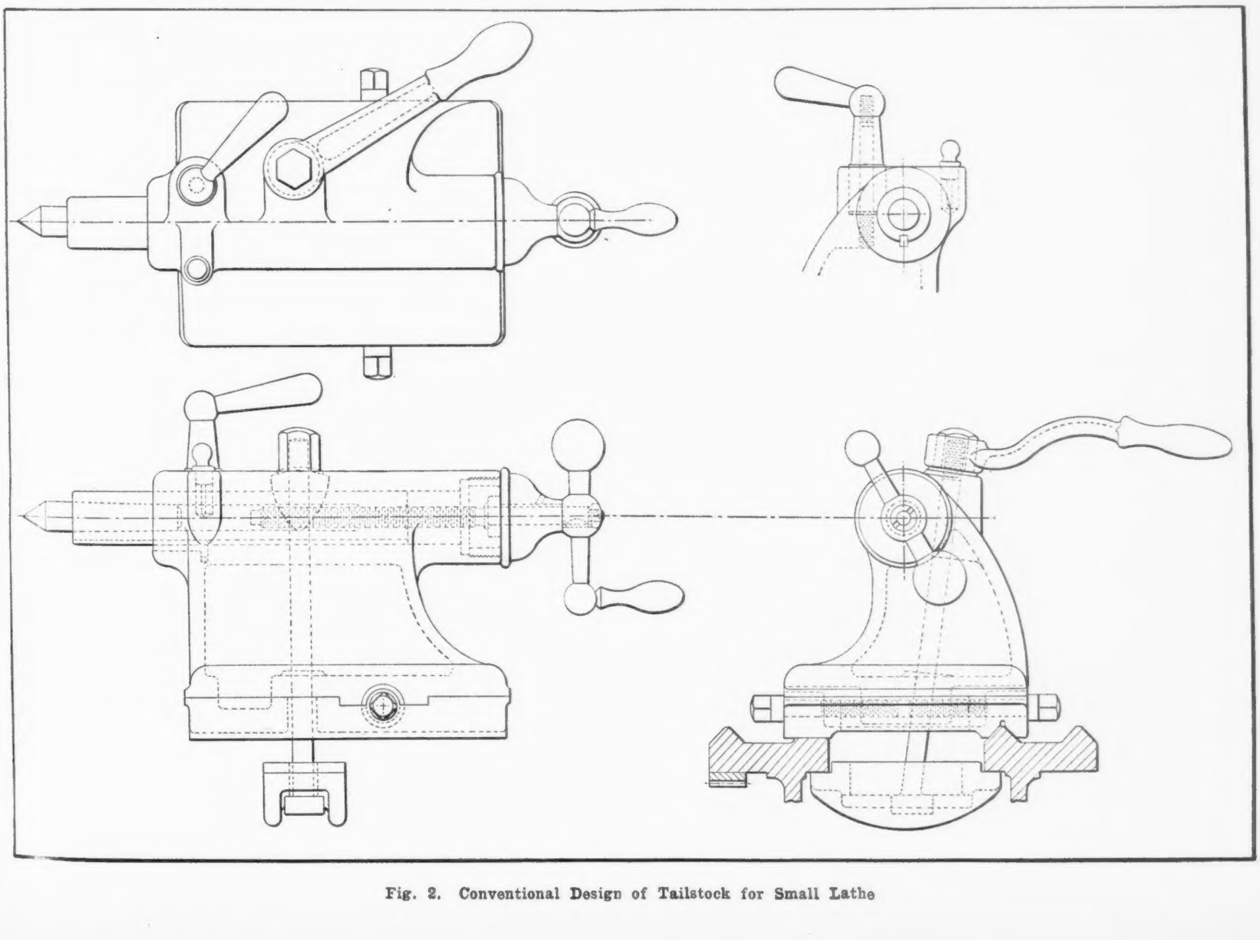


Fig. 2. Conventional Design of Tailstock for Small Lathe

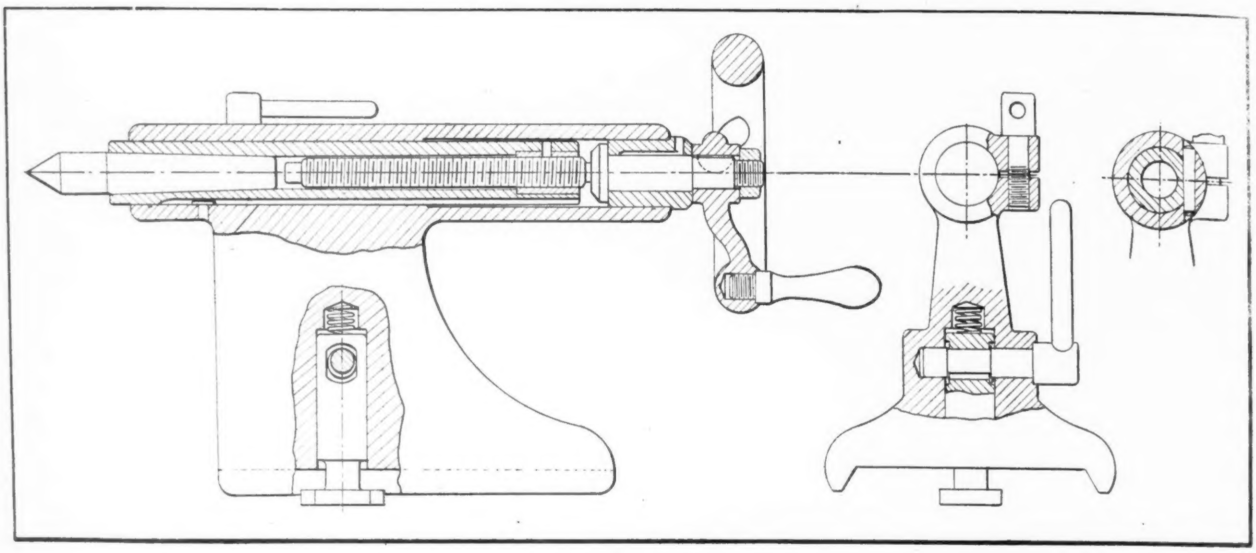


Fig. 3. Design of Tailstock used in a Small Bench Lathe

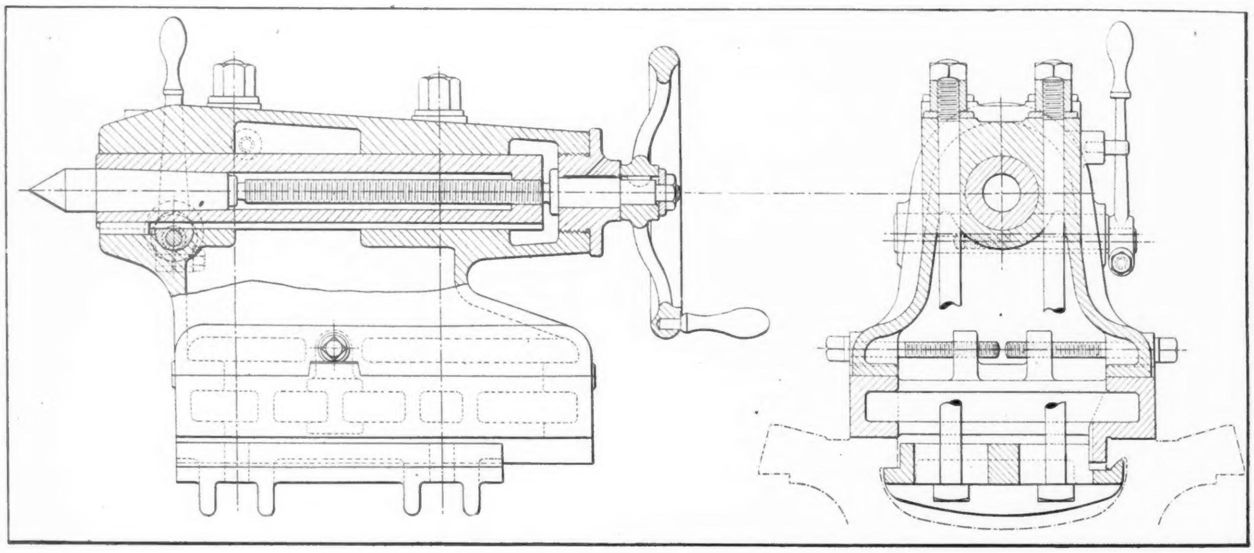


Fig. 4. Rigidly Constructed Tailstock with Special Clamping Device

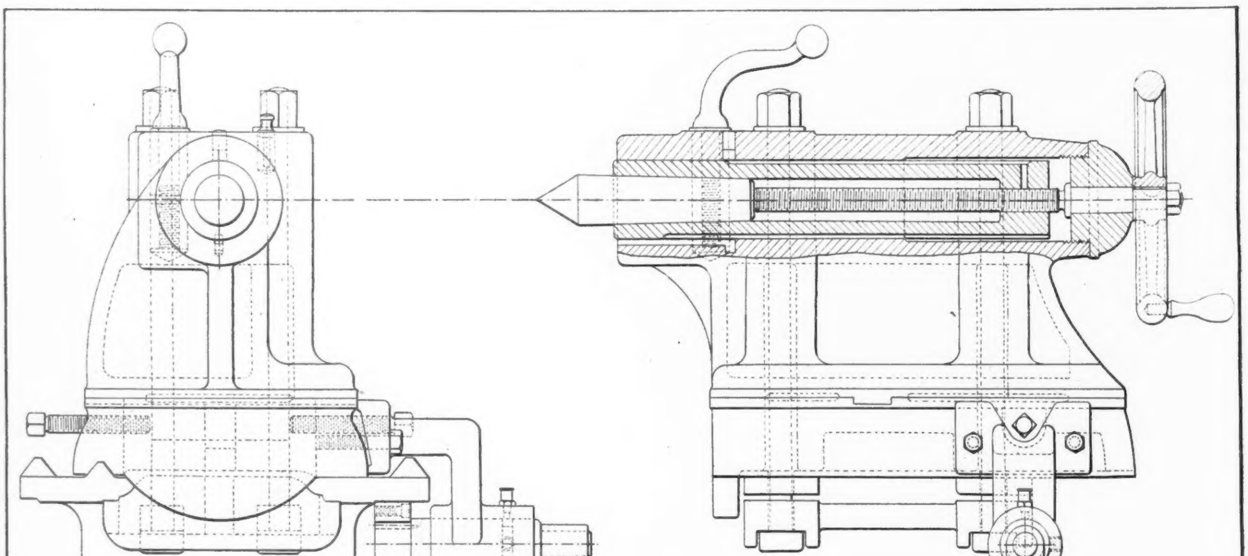


Fig. 5. Tailstock with Vertical-spindle Binder

The usual type of eccentric binding clamp is used to secure the tailstock to the lathe bed.

Spindle Clamping Methods

The tailstock illustrated in Fig. 2 is used on the small "Star" lathes made by the Seneca Falls Machine Co., and may be termed a conventional design. The base is guided by one vee that is independent or separate from the vees that support the lathe carriage. The single clamping plate is drawn up by an inclined bolt, located in a convenient position for the clamping handle. The base of the tailstock has a simple set-over arrangement that provides for taper turning. The spindle is secured by a binding pad which is pressed down by the nut on the clamping handle.

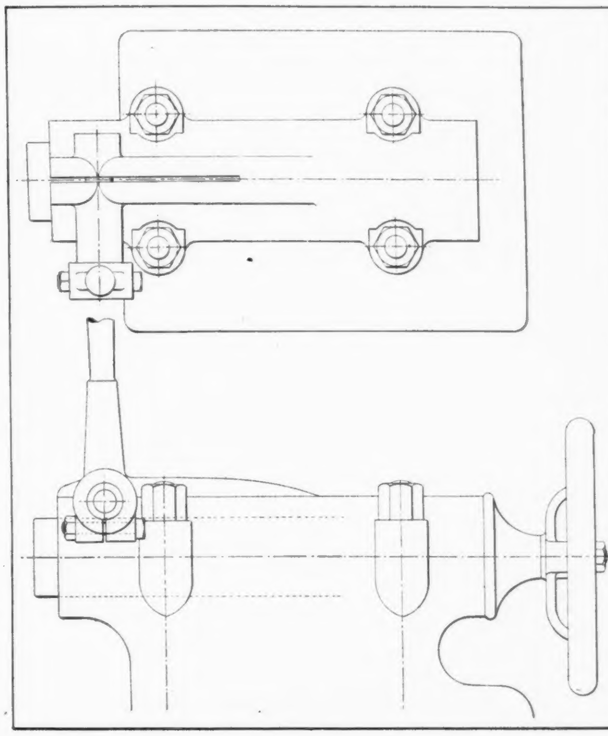


Fig. 6. Heavy Tailstock of 20-inch Lathe

Two different methods are employed for clamping the spindles of tailstocks in place: In one, the front end of the center-holding member is contracted to grip the center, and in the other, the holder is left solid and a binding stud is employed to secure the center in place. Some designers claim that the proper method is to provide means for contracting the front end of the casting by splitting this member and using a bolt or stud to obtain a close fit, and thus compensate for wear which may result in producing a slightly bell-mouthed bearing. Alignment is maintained by this contracting member, which centers the spindle or at least pushes it toward one bearing surface or point. Theoretically, the accurate alignment of a center can be accomplished only by employing some means of obtaining uniform contraction of the holder around the center.

Designers who favor the second method claim that splitting the holder weakens this member and that the holder should be left solid. With this design, a binder having a sufficient arc of contact on the center is employed to clamp the center-holding member in place. It is practicable, however, to arrange a split holder so that it will have ample strength, by making the parts heavier and using one or two binding bolts of suitable size. This practice, for instance, is employed in constructing the heavy tailstock for the 20-inch rapid-production lathe built by Wickes Bros., a detail of which is shown in Fig. 6. In this design, the metal is well distributed around the split portion of the base casting.

In Fig. 1 is shown the design used on a 27-inch lathe built by the Pittsburgh Machine Tool Co. The split in the tailstock casting is well supported by two screws, one for binding or clamping the center in place, and the other for adjusting the bearing to a good sliding fit over the spindle or barrel.

In the design shown in Fig. 8 a special screw is used to keep the bearing adjusted to a close fit over the barrel. This design is employed on the LeBlond 11-inch rapid-production lathe, and is similar to that used on the overhanging arm of the milling machines made by this company. It consists of a stud with a shoulder, which can be adjusted to maintain a close fit and yet permit the barrel to slide in the holder. With this arrangement, the tightening and loosening of the clamping screw does not affect the barrel fit. Referring to the end view, it will be seen that the base of the tailstock is guided by a single vee of the usual shape, although a vee of special shape, with a sloping face, is used to take the thrust of the carriage at right angles to the thrust pressure on the tool.

Other Clamping Devices for Tailstock Spindles

A number of manufacturers employ split block clamps for binding or clamping the spindle in place, which are drawn together so that they bear on the periphery of the center-holding spindles. This method is employed by the Lodge & Shipley Machine Tool Co. The tailstock of the 18-inch lathe built by the Cisco Machine Tool Co., as shown in Fig. 7, embodies this feature, the binder being shown separately in the lower right-hand corner of the illustration. This illustration also shows that the tailstock is guided by one vee and that four hold-down bolts are used to clamp the tailstock in place. It will be noted that a rack is provided to facilitate moving the tailstock along the lathe bed by means of a pinion and crank or handwheel.

The rigidly constructed tailstock shown in Fig. 4 is used on the 21-inch high-power lathes built by Joseph T. Ryerson & Son, Inc. The spindle-binding eccentric stud is located on the lower side of the center. A special type of clamp which engages an inverted vee is used to secure the tailstock in place on the lathe bed. This arrangement serves to pull the base over into contact with a vertical guiding lip, which is subject to very little wear.

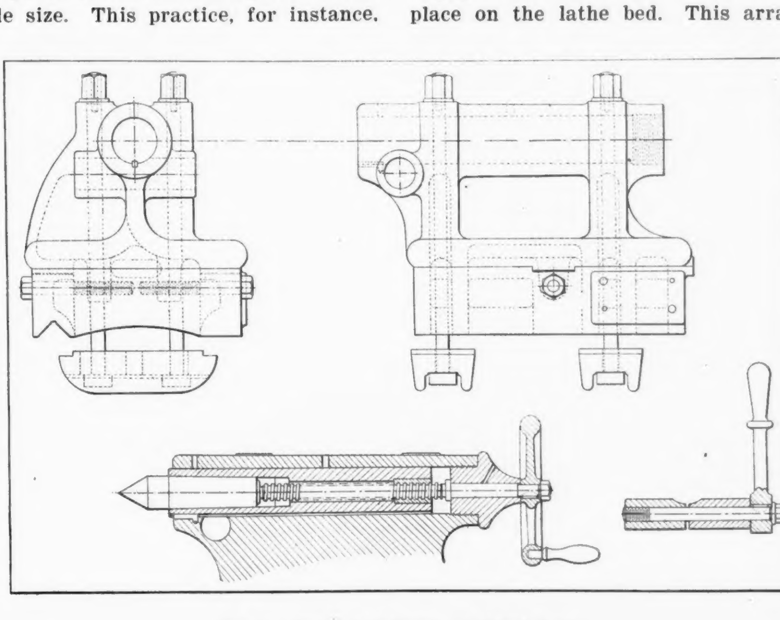


Fig. 7. Rack-fed Tailstock of 18-inch Lathe

A few lathe manufacturers prefer to locate the binding screws in a vertical position, as is done in the Reed-Prentice 20-inch high-speed lathe, the tailstock of which is shown in Fig. 5. Referring to this illustration, it will be noted that the tailstock is guided by one vee on the lathe bed and that a rack and suitable mechanism is provided for moving the tailstock along

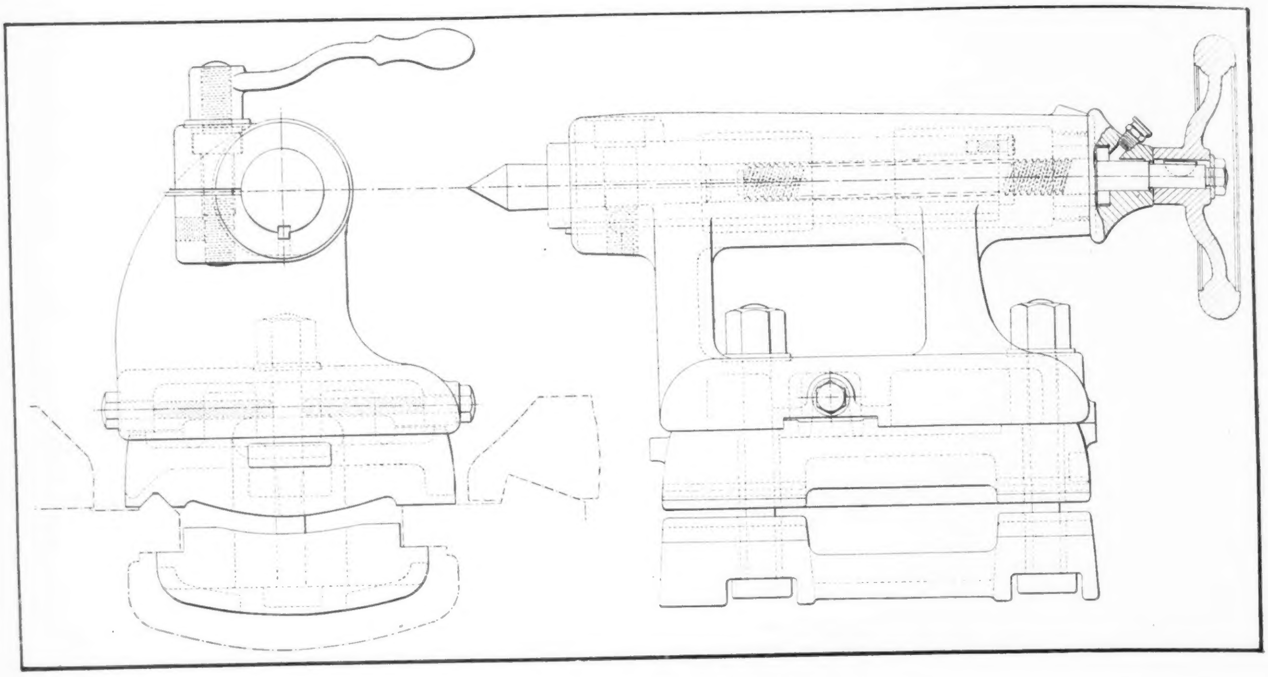


Fig. 8. Adjustable Bearing Tailstock of 11-inch Lathe

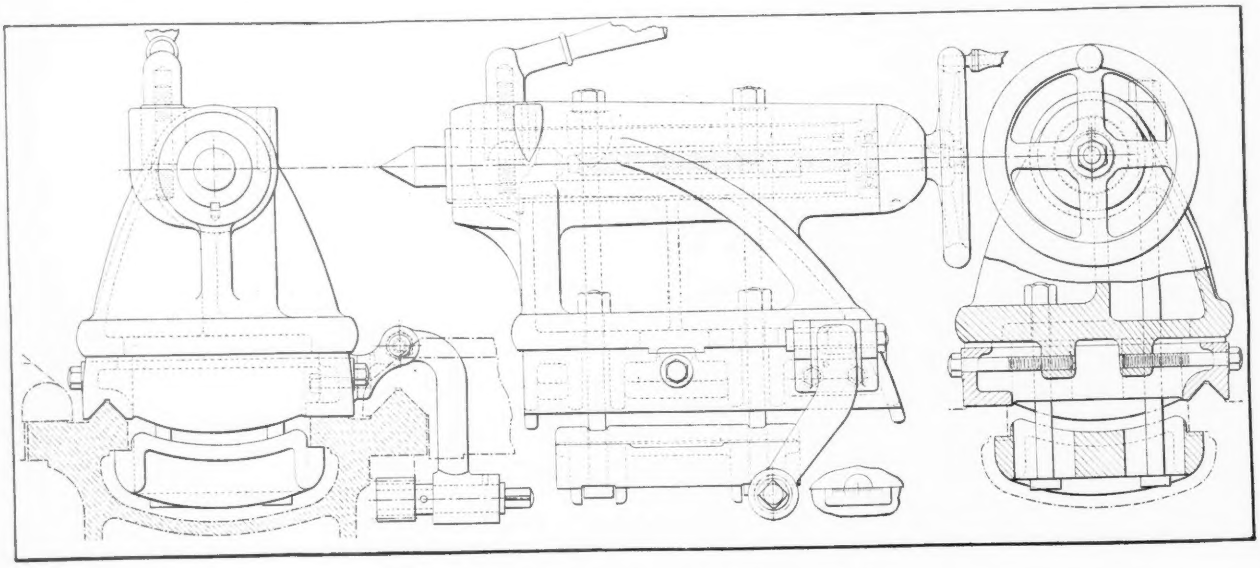


Fig. 9. Tailstock with Rack Feed and Ball-thrust Bearing

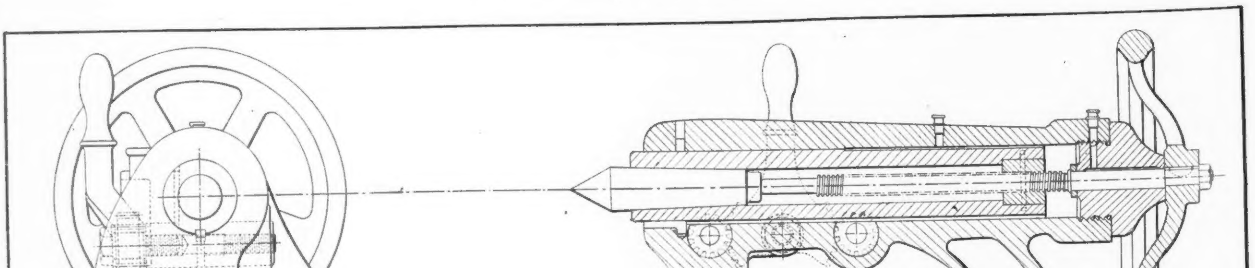


Fig. 10. Type of Tailstock provided with Rigid Clamping Devices

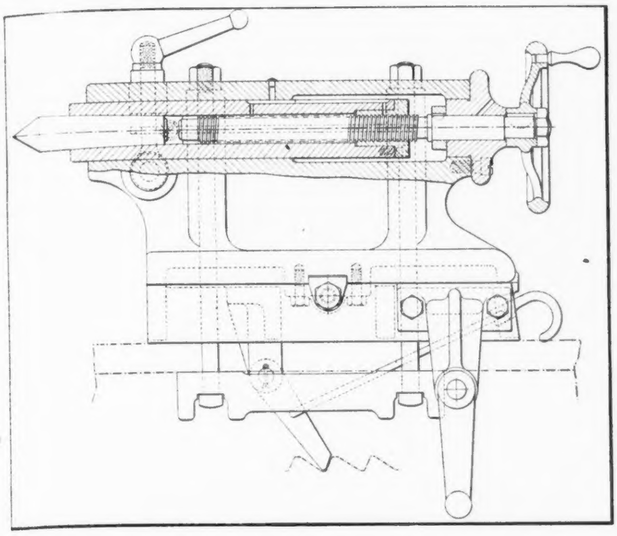


Fig. 11. Tailstock with Light-pressure Clamping Device

the lathe ways. The bed section of the lathe manufactured by the Monarch Machine Tool Co. has only two vees, one of which guides the carriage and the other the tailstock, as indicated in Fig. 9. The rack mechanism for moving the tailstock is of the pivot tip-up type. A spindle-binding screw is at the back side and a little above the center line. Located within the bell at the rear end of the tailstock is a ball thrust bearing, which reduces the friction when feeding a drill or other tool by means of the tailstock handwheel.

Tailstock Spindle with Double Clamping Bolts

On the lathes built by the Greaves-Klusman Tool Co. provision is made for two clamping or binding bolts, as shown in Fig. 10. It is primarily the purpose of this construction to prevent springing the spindle out of alignment. The two clamping bolts have a floating action, which causes them to grip the spindle simultaneously when the pinions of the tightening screws or bolts are turned by the operating handle. The clamping bolts can be adjusted separately, and require no attention after they have once been adjusted. Referring to the illustration, it will be seen that there is a pawl in the base of the tailstock, which can be dropped into engagement with a rack in the lathe bed in order to prevent the tailstock from backing away when heavy cuts are being taken. The base of the tailstock slides on a special vee-way, and the carriage is supported by special vee-ways, the front vee having a double angle which gives the carriage an increased bearing surface. The rear vee is located at a point level with the flat on the front ways in order to increase the swing of the lathe.

A variation from the usual type of spindle clamping arrangement is shown in Fig. 11. In this design, the clamping member is lifted by an eyebolt, which is drawn up by the nut on the end of the clamping lever. A light pressure on the binding bolt of the device is sufficient to clamp the spindle securely in place. A clamping device of this type is employed on lathes built by the Lehmann Machine Co.

* * *

One reason for the rapid development of commercial aviation in Europe has been the subsidies granted by a number of the European governments. In England, for example, the government has granted a subsidy of £1,000,000 to be spread over a period of ten years to a commercial aviation company, stipulating, among other conditions, that it should maintain efficient transportation service between London and Paris, London and Brussels, London and Amsterdam, and Southampton and the Channel Islands.

CHUCK FOR THIN-WALLED WORK

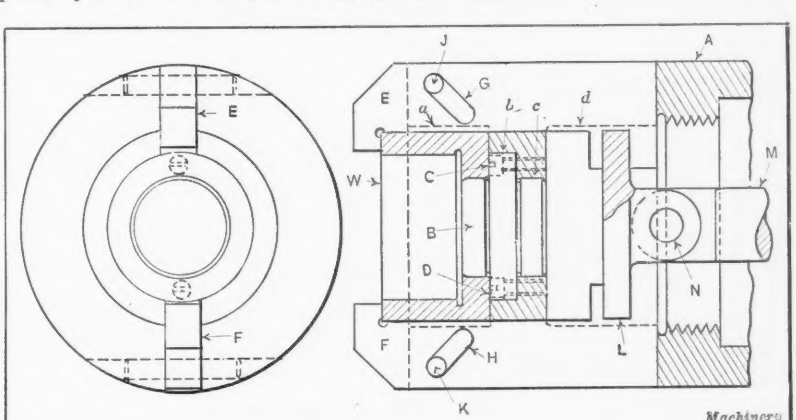
By FRANCIS J. DITTMAR, Consulting Engineer, Buffalo, N. Y.

In the accompanying illustration, is shown a chuck designed for holding thin-walled work while internal machining operations are being performed. This chuck has a cast-iron body *A*, one end of which is machined to fit the spindle of the machine on which it is to be used, while the other end is bored to the outline indicated by the lines *a*, *b*, *c*, and *d*. The bore indicated by the line *a* is made slightly larger than the outside diameter of the work *W*, which is located centrally on the pilot *B*. The lines *b* and *c* indicate the seat of the pilot, while the line *d* indicates a recess of sufficient diameter to clear the member *L*. The pilot is held rigidly in place by the two screws *C* and *D*.

Two 1/2-inch slots are cut into the body to receive the jaws *E* and *F*, which are located diametrically opposite each other. The jaws are milled as shown, and have slots at *G* and *H*, which are located at an angle of 45 degrees. The pins *J* and *K* are drive fits in the body and pass through the slots in the jaws. The jaws are actuated by means of the disk-shaped member *L*, which is connected with the rod *M* by a hinge pin *N*. The rod *M* extends through the spindle of the machine, and is, in turn, acted upon either by a cam lever, screw and nut, or an air cylinder or piston. Of the three means mentioned, the air cylinder is the most efficient, although a cam action is suitable, provided the diameter of the work is held within rather close limits. A stiff spring between the cam and the spindle of the machine may be used unless a very heavy cut is required, as, for instance, in cases where thread milling operations are to be performed.

It is obvious that the pins *J* and *K* which extend through the slots in the jaws will spread the latter members apart when the work is released, while the projecting ends of these jaws take the entire working strain. For this reason, three jaws are often employed. In the illustration, only two jaws are shown, for the sake of clearness. When three jaws are used, the hinge pin hole in the draw-rod and disk is made slightly larger than the hinge pin, in order to give the effect obtained with a universal joint.

If the work permits, the gripping faces of the jaws may be serrated or roughened, so they will embed themselves in the metal. The angle for the slots is arbitrary, and may be made greater or less than 45 degrees, as conditions demand. If the work requires a large spread of jaws with a slight head advance, the angle should be greater than 45 degrees, and if the pilot must be of considerable length and the walls of the work are thin, it should be less than 45 degrees. When slots are milled in the bottom of the work or the internal surfaces present any unevenness, this may be taken advantage of by machining the pilot face to conform to the shape of the work. The writer has even found it advisable to mill a small slot or drill a hole in thin-walled work, into which a pin or a key is fitted, which will do the actual driving while the fixture serves simply as a holder or nest for the part being operated upon.



Chuck designed to hold Thin-walled Work

The Organization of an Industrial Plant

By J. SETON GRAY,* Industrial Engineer, A. O. Smith Corporation, Milwaukee, Wis.

THE success of any shop organization depends on how well the general superintendent can get all kinds of men to work together in a team. If the average superintendent understood the value of teamwork, as a football coach or captain does, or as a baseball manager when he introduces a new infielder into the game, he would spend a great deal more time in being sure that the personnel of the organization is right before allowing them to work out their own problems. Good teamwork among the factory heads is essential to obtaining the best results.

The general superintendent is represented in every department by assistant superintendents and foremen. These men get their instructions directly from him, and represent the management throughout the factory. Every man who is in a position of responsibility should realize that he represents the management and that his actions will be taken as an example of how the management wishes to treat the employes.

Supervision of Production

The production manager should always be in close touch with the general superintendent. He is responsible for the scheduling of material through the factory, and must see that material reaches the various departments in time so that all men and all machines are kept running to capacity; idle men and machinery mean increased costs. He is also responsible for raw material received from outside sources, and must keep in close touch with the stores department, receiving department, and traffic department, if he is going to bring his schedule through to a successful completion at the end of the month.

The production manager is also responsible for the maintaining of production records. He must see that the "stock chasers" understand their job and the product. Stock chasers must know every operation that will be performed, and be able to estimate closely future deliveries. Good stock chasers are a great help to the production manager and relieve him of many details, enabling him to keep in closer touch with the factory.

Time- and Cost-keeping Departments

The works accountant has charge of all factory accounting, such as timekeeping, costs, and payroll, and should furnish sufficient information to the general superintendent so that he may know what the conditions are in the factory. In many shops, the works accountant is responsible to the secretary, treasurer, or auditor, the reason being that he must furnish them with the necessary information so that the final balance sheet for the whole factory can be compiled. In any case, the works accountant must be in close touch with the general superintendent and keep him posted on the many items entering into the costs, which can only be learned as he compiles his records.

The works accountant should furnish the superintendent each day a record of the total hours that were worked in the factory the day previous, how this time was distributed—production hours, non-productive hours, over-time hours, and night gang hours, what the earnings were in all departments, and what men or departments seem out of balance. If certain men are earning a normal rate for a period of time, and they suddenly begin earning 50 per cent more, it is his job, through his organization, to record this, and call it to the attention of the general superintendent.

He must watch the charges on all jobs and see that they are properly distributed; if these charges appear excessive he must find out why, and see that everybody else who is interested knows about it also. He should be able to furnish the general superintendent with any special information he requests, and if this is not available, find ways and means of getting it.

The Storekeeping Department

The storekeeper must look after all supplies that are needed. In many factories, he is responsible to the works accountant, but as his dealings are all with men in the factory, he really should report to the general superintendent. It is his duty to see that all supplies purchased outside, such as bolts, nuts, rivets, nails, screws, pipe fittings, electrical fittings, etc., are on hand when required. He is responsible for these purchases, and must see that they reach their proper destination and that the proper job is charged.

The storekeeper and his helpers are brought in contact with the rank and file of the factory and have all their dealings with them. It can readily be seen that no man with a quick temper can hope to be successful at this class of work. The storekeeper and his assistants should be able to stand a lot of abuse without taking offense, as they are there to give service and must see that nobody is kept waiting.

The Plant Engineer or Master Mechanic

One of the most important positions in any factory is that of plant engineer or master mechanic. His duties are so numerous that it is almost impossible to list them. He must see that steam and power is distributed throughout the factory at as low a cost as possible. He is responsible for all repairs—electrical work, steam fittings, carpenter work, machine repairs; in fact, anything that needs to be repaired comes under his jurisdiction. It is his duty to see that every piece of equipment is ready whenever called for, and at the same time he must be sure that unnecessary expenditures are not being made.

The plant engineer's job calls for a man who can intelligently spend a great deal of money. A good plant engineer is a real asset to any shop. When a man is needed for such a position, the main consideration should not be how cheaply a man can be obtained for the job. In many factories this position carries the title of "mechanical superintendent"; he is an under-study to the general superintendent. He must be a "jack of all trades" and at the same time a master of them all, and when called on, be able to prove by actual figures that his ideas are based on a firm foundation. Such a man must be quite a diplomat, as he will have dealings with every department in the factory. Naturally every foreman feels that his own department is the only one that really need be given any attention. It is the plant engineer's job to satisfy them all, and at the same time to do it as cheaply as possible.

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The repair boss generally works for the mechanical superintendent. This man should be a born mechanic and have a natural love for orderliness and cleanliness. He must be a man of good judgment, and when he feels that machinery and equipment are being abused, he must be able to take steps to remedy that condition. He must have the ability to sense trouble and take steps to meet it before it happens; an efficient repair boss is not the man who can take care of things when they are broken down, but a man who can see breakdowns coming and take steps to prevent them.

Time Study and Planning Department

The head of the time and motion study department reports directly to the general superintendent. This position must be filled by a man who can use good judgment, because in factories where piece-work, bonus, or premium plans of payment are used, he actually controls the men's earnings. He must be able not only to make time and motion studies, but also to determine when the men are holding back. When a rate is set, it must stay set if harmony is to prevail. A time-study man should be able, if necessary, to perform every job on which he places a rate. A machinist or toolmaker who has a knowledge of mathematics will generally make a much better time-study man than an engineer.

There has been a tendency lately to allow this work to drift into the hands of college graduates with little practical experience. As the job, however, calls not only for a man who can use a slide-rule, but also for a man who can rub shoulders with the rank and file of the shop, the shop foremen, and superintendents, the best results are obtained with men who have had lengthy shop experience. In the average factory today, a great deal of work is on an incentive basis, so that the percentage of the total payroll controlled by the time-study man is quite large; consequently, it is essential that the man picked for this job be of high caliber if the best results are to be achieved.

The Employment Department

It is the duty of the employment manager to see that the factory is supplied with efficient labor, and he must be able to meet the demands for whatever the factory requirements may be. The employment manager should have a pleasing manner and happy disposition, as applicants for work form their first impressions of the factory from the way they are received in the employment office. Some man will say: "I never would work at such and such a place; it is the worst place I ever was in in my life." On inquiry it will be found that he has only been to the employment office of this factory, but his reception there convinced him that he did not wish to become identified with that organization.

The employment manager must be able to get all the information he requires without embarrassing or antagonizing the applicant. This he must do if he hopes to place men intelligently so that they will stay "put." He must always be willing to listen to the reasons why men won't stay, and why certain foremen desire men five feet ten inches tall, and why men six feet tall are no good. He should know the specifications that must be met for the jobs in all departments, and if there is a misfit, he must be able to keep the department satisfied until the proper man can be obtained.

It cannot be emphasized too strongly that the employment manager represents the management and is the first point of contact that the new employe has with the business; the first impression will go a long way toward establishing friendly relations between the men and the management.

The Inspection Department

The chief inspector is an autocrat and feels that he is responsible to nobody, not even to the president of the company. His job is to see that the product leaves the factory in such a way that there will be no complaints by customers. Of course, it must be kept in mind that the main idea of being in business is to make a profit, and if the chief inspector insists on impossible limits, it would not be long before the factory would close its doors. For this reason, in many factories, the inspector is responsible to the general superintendent. This, however, is a great mistake, as the superintendent is responsible for the output, and might be tempted to sacrifice inspection, in order to get higher production.

On the other hand, the chief inspector is responsible for all complaints, and regardless of whether or not he has been overruled by the management, he is always held responsible. The best arrangement if the inspector is level-headed is never to over-rule him, but let him know that he is responsible for all the product and that he is expected to use his best judgment at all times before insisting on his demands being met.

The poor inspector is one who merely states "This work will not be accepted," and leaves it to the other fellow to find out why and take the necessary steps to remedy the condition. A good inspector must be able to cooperate with the production foremen, so that rejected material and scrap can be kept down to a minimum. The value of an inspector cannot be measured by how much material he rejects, but rather by how little he rejects while at the same time, keeping the quality of the product up to a standard that meets the customers' requirements. Not only must the inspector know the organization of his own factory, but if possible he should be on friendly terms with the customers, and know the leading men in the organizations who use his product. In this way he will know first-hand the requirements that must be met, and can intelligently talk over all problems with the customer.

Miscellaneous Shop Departments

There are many other jobs that are important in the welding together of an organization, among which are the toolroom foreman, the shipping clerk, and others; but the functions of these departments are generally understood, and mention has only been made of the "king-pin" men in the organization.

In order to obtain the best results, there should be some means of measuring the results, and it should be the aim of every superintendent to be able to gage the work of any department or of any foreman from concrete facts. In some factories it is difficult to do this, but there is always some unit that can be used as a means of measurement, so that effort can be gaged. It may be the total output of the whole factory, or the output of some other department which is being furnished with material. Regardless of what it is, some unit of measurement must be obtained if the maximum effort is to be obtained from the organization.

The Industrial Engineer

In many factories today, you will find someone in a corner office who is known as the "leak hunter," the statistician, or industrial engineer. It is his job to furnish the superintendent with facts and figures on anything he may wish to know. This man should know various branches of engineering, be a skilled accountant, and know production. As the designer strives for greater efficiency by eliminating losses from machinery and equipment, so the industrial engineer, by studying factory conditions, strives to eliminate losses and waste in factory operations. He does not require detail knowledge of the product being manufactured, as production principles are the same in all factories. Such a man is really a doctor trying to locate the disease and apply the remedy.

The industrial engineer must be on speaking terms with every man in the factory organization, and be able to show everyone what is being accomplished in his particular department. He will be called on to present information to men who will resent it, and must be able to stand being criticized. He must have a perfect understanding with the general superintendent. He should be, in fact, an understudy to the general superintendent.

It is difficult to get men and foremen to adopt new ways and means of performing operations. Many new ideas may be introduced, but if not given a fair trial and followed up, they will be side-tracked. There should be someone connected with the organization who will see that all new ideas are given a fair trial, and will not be discarded just because the organization feels that it has no desire to make a change.

The Importance of Teamwork

If a manager or foreman would give the same thought and consideration to teamwork as the manager of a baseball team does, there would be more harmony in the organization and better results obtained. No matter how good the general superintendent, or the plant engineer, or the production manager may be, if they cannot pull together as a team, the product will cost more than it should.

One of the greatest problems confronting a superintendent, therefore, is to take from five hundred to five thousand men and make them work together. It requires real personality to so impress your subordinates that they will think and act as you would in like circumstances, but that is the secret of good organization. Any organization, to be successful, must develop men that are leaders, not leaners. The men must be taught to think and act, and not wait until someone tells them what steps should be taken; and when authority is delegated to a man, he should be given responsibility at the same time.

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POINTS ON WINDING HELICAL SPRINGS

By S. W. BROWN

Helical springs are either close or open wound, depending on the purpose for which they are intended. The methods here outlined for making springs of this kind are suitable for the ordinary machine shop when the limited production does not warrant the use of expensive equipment. Small and medium size springs are made of a bright, finished product known as music wire. This wire is especially suitable for the purpose, as among other good features it does not require heat-treatment. All helical springs expand after winding; hence the mandrel on which they are wound must be smaller than the inside diameter of the spring required.

It is impossible to calculate accurately the size of a mandrel for a given size spring, because of several variable factors that are always present in the problem. Consequently it is necessary to select the mandrel by trial. In most cases, a mandrel having a diameter equal to about 7/8 of the inside diameter of the required spring serves well enough for a trial. If the diameter of a spring wound upon the trial mandrel should prove to be incorrect, the necessary correction can usually be made by using a new mandrel made enough larger or smaller to compensate for the error. Sometimes, however, further trials are necessary.

Making Close-wound Springs

The procedure in making close-wound springs is as follows: First select the correct size mandrel, which may be a cold-rolled steel bar about 18 inches long, with one end centered. One end of this bar is held in a lathe chuck, and the centered end supported by the footstock center. Next enough wire is released from the stock coil to make the number of springs required, or at least to wind the full length of the mandrel. The end of the wire must then be fixed near the chuck by inserting it between the chuck jaws or through a hole previously drilled in the mandrel.

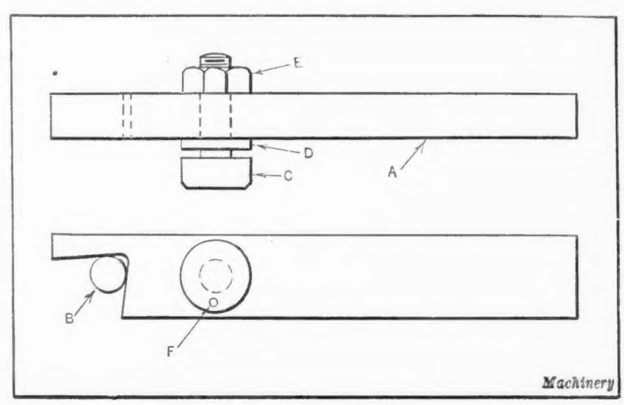
The next step is to wind the wire on the mandrel. During this operation, the wire must be kept taut by means of a clamp. A wooden or iron clamp held in the hand is commonly employed for this purpose, and while such tools give fair results, they require considerable skill in their manipulation in order to produce evenly wound springs. Consequently some sort of clamping device designed to be held in the toolpost is desirable. Good results may be obtained by employing a device similar to the one illustrated.

The shank *A* is made to be held in the toolpost. The notch in the end serves to support the mandrel *B* on the same principle as a lathe follow-rest. The wire is clamped between the stud head *C* and the washer *D* by tightening nut *E*. Both members *C* and *D* are prevented from turning by the pin *F* which is tight in *A* and a free fit in *C* and *D*. Pressure exerted in winding the spring will often feed the lathe carriage without the operator's assistance.

Some attention should be given to the position of the wire coil while the wire is being unwound from it and wound on the mandrel. The coil of wire may be suspended from a nail driven into a box. If held or placed in any other position, as, for instance, if laid on the floor, the wire will often wind unevenly on the mandrel.

The wire should not be cut off and the spring allowed to expand suddenly at the end of the operation, as this may injure the operator's hands and distort the work. Instead, the mandrel should be given a few revolutions backward, which will allow the work to expand slowly to its normal size. After removing the work from the mandrel it is ready to be cut into spring lengths. A thin cold chisel is useful for this purpose.

Close-wound springs usually have loops or eyes at the ends. These may be formed by inserting one jaw of a pair of thin pliers between the first and second coils and bending



Tool for winding Helical Springs

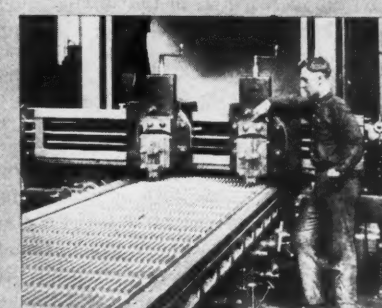
about a half coil into position. Springs made of very small wire may be held by hand during this operation, but the larger sizes must be held rigid. A satisfactory method of holding the spring while bending the loops is to insert a soft steel plate about 1/32 inch thick and slightly wider than the spring diameter between the first and second coils of the spring, and then clamp both the spring and plate between the jaws of a vise, one side of the spring being in contact with one jaw and the edge of the steel plate in contact with the other vise jaw.

Making Open Springs

Open springs are wound the same as closed springs, except that provision must be made to keep the coils separated while winding. Good results may be obtained with the device shown in the illustration by gearing the lathe as for screw-cutting, in order to separate the coils. However, for springs made of quite small wire, the lathe need not be geared, but, instead, a wire hook may be used between the coils to obtain the required spacing.

A steel plate of the same thickness as the spaces required between the coils may be employed in place of a hook. This may be attached to stud *D* and pin *F*. In this case, the wire is clamped between the steel plate and washer *D*. The end of the plate is set against the mandrel. Open springs that are cone-shaped may be wound on a taper mandrel with a helical groove cut on it, having the same pitch as the spring required. It is poor practice to make open springs by stretching closed springs. Such springs often become set permanently in a short time. It is a good plan to save all surplus and trial springs for use in an emergency job.

Letters on Practical Subjects



SEMI-AUTOMATIC TAPPING MACHINE

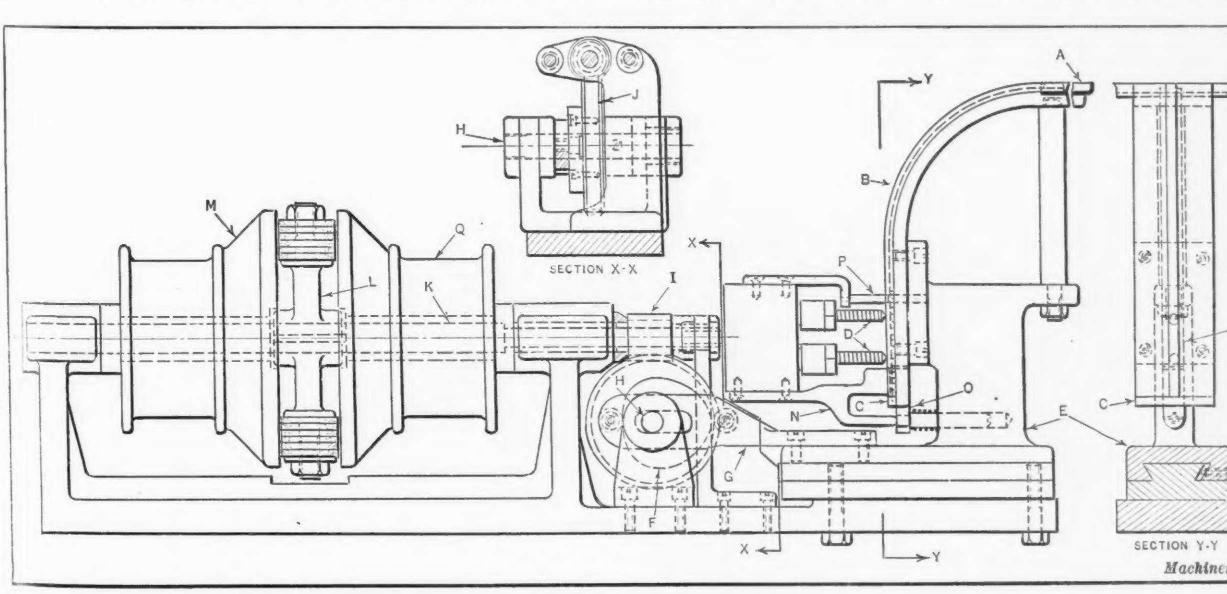
Some time ago the writer was confronted with the problem of tapping over one million small hexagonal brass nuts. The nuts were 3/8 inch across the flats, 1/16 inch thick, and had a hole through the center 3/16 inch in diameter. A 1/4-inch tap having 32 threads per inch was to be used. As repeat orders were expected, it was decided that it would be more economical to build a light tapping machine capable of high production than it would be to employ a standard machine equipped with special tool equipment. A standard tapping machine frame was used, however, the rest of the mechanism, which is shown in the accompanying illustration being built in the machine shop. The operation of the machine is described in the following.

A quantity of blank nuts are first placed in the feed pan *A* and fed, one at a time, into the top of the chute *B*. The cross-bar *C*, at the bottom of the chute, serves as a stop for the nuts. The taps *D* are spaced to line up with the holes in two of the blank nuts. The taps are so spaced that there are two nuts between the ones being tapped. The slide *E*, which carries the feed chute, has a continuous reciprocating motion, the taps being fed through the nuts on the forward movement and out on the return movement. The reciprocating motion is imparted to the slide by the cam *F* through the link *G*. There are two rollers on link *G*, one on each side of the cam. This arrangement insures a positive reciprocating motion. Cam *F* is mounted on a short jack-shaft *H* driven by worm *I* which meshes with worm-wheel *J* secured to the cam and shaft *H*, as shown in section *X-X*.

The pressure exerted on the taps *D*, when the slide *E* is fed forward, causes the tapping chuck on the shaft *K* and the leather-headed trunnion *L* to be moved back until contact is made between the trunnion and the friction face of the pulley *M*, which is belted to an overhead shaft. This movement causes the taps to revolve in the proper direction for tapping the threads. While the inward feeding movement is taking place, the finger *N* pushes the two nuts at the bottom of the chute out until the plunger or back-stop *O* is pressed back far enough to release the nuts and allow them to drop from the machine.

The nuts are prevented from turning while being tapped by the finger *P* and the upper surface of the ejecting finger *N*. The flat on the nut being tapped by the lower tap, rides on the flat surface of finger *N*, while the pin *P* passes through the hole of the blank nut, thus preventing the nuts from turning. The chute is made wide enough to allow the nuts to be fed into it with their flats in contact.

After cam *F* has carried the slide to the extreme left-hand position and begun the return stroke, the leather-faced member *L* is withdrawn from contact with the face of pulley *M* and into contact with the friction face of pulley *Q*, which is driven by a cross-belt from the overhead shaft. This action causes the tapping spindles to be reversed so that the taps are fed out from the nuts without stripping the threads as the slide *E* returns to the position shown in the illustration. When the slide has reached its extreme outward position, the finger *N* clears the nut at the bottom of the chute and allows the whole column of nuts to fall a distance of 3/4 inch, or the distance across the flats of two



Two-spindle Semi-automatic Tapping Machine used for tapping Brass Nuts on a Quantity Production Basis

nuts. This completes one cycle, which is repeated as long as the machine is kept running and the feed chute supplied with blank nuts.

The spindles in the tapping chuck have a gear ratio of 1 to 1. The pulley *Q* has a hardened steel bushing which extends through the bearing and engages the clutch teeth on the hub of worm *I*, so that a continuous drive is obtained for the jack-shaft on which cam *F* is mounted.

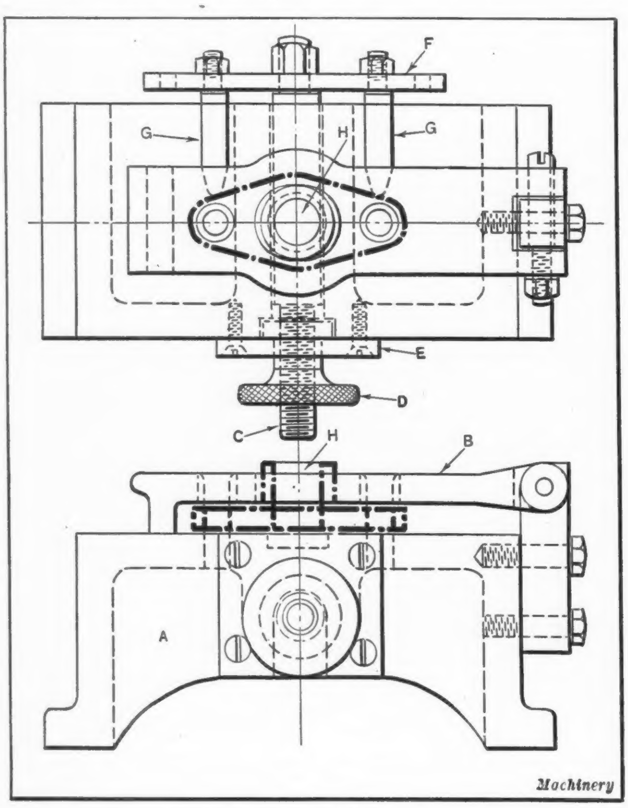
Bridgeport, Conn. JOSEPH E. FENNO

DRILL JIG FOR STUFFING-BOX GLANDS

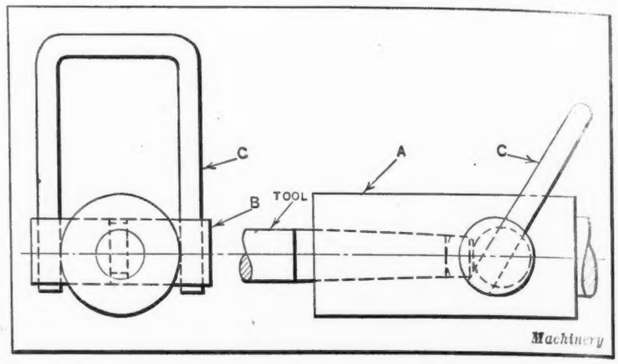
In the accompanying illustration is shown a jig for drilling stuffing-box glands such as are commonly used on steam engines and pumps. Jigs of this design have been found rapid in operation, and high production rates are obtainable with them when a multiple-spindle drilling machine is employed. The production rate can also be nearly doubled by using two jigs of type shown, mounted on an indexing fixture in such a manner that the operator can load one jig while the part held in the other is being drilled. The body of the jig is designed to hold stuffing-box glands of various sizes and shapes, it only being necessary to change the locating plug *H* and bushing plate *B* to suit the gland to be drilled.

The body *A* of the jig is a box-type casting having one open end and a boss running the entire length of the casting which is bored to receive the steel rod *C*, and counterbored to receive the small end of nut *D*, which is held in place by plate *E*. One end of rod *C* is threaded to fit nut *D*, and the other end to fit plate *F*. Plate *F* has a series of holes in it, in which equalizing bars *G* may be placed to adapt the jig for holding glands of different sizes. When the work, shown by heavy dot-and-dash lines, is placed over the locating plug *H* and nut *D* is tightened, the equalizing bars *G* will come in contact with each end of the flange, thus holding it in the correct position for drilling. After the drills are well started, the nut *D* is loosened to relieve the pressure on the flange. The bushing plate *B* is hinged at one end, as shown, and has a projecting rib at the opposite end which serves to hold it in a horizontal plane when in the correct position for drilling.

Battle Creek, Mich. BRUCE DEVEREAUX



Drill Jig for Stuffing-box Glands



Quick-acting Ejector for Taper-shank Tools

EJECTOR FOR TAPER-SHANK TOOLS

The quick-acting ejector here illustrated was designed to facilitate the rapid changing of taper-shank tools employed on a turret lathe job that required the use of more tools than could be held in the turret at one time. Part of one operation performed at one chucking consisted of drilling and reaming a 1 1/4-inch hole. Two reamers were used on this job, the first one being 0.005 inch under size.

By the aid of the quick ejecting tool shown, it was possible to change the drill and the two reamers more quickly than they could be indexed into place when held in separate holes in the turret. The holder *A* was bored out to receive the taper shanks of the drill and the reamers, but instead of having the usual slot at the end, a hole was drilled through the holder to receive the piece *B* which had an eccentric groove turned at the center. This groove was made slightly wider than the thickness of the tangs of the tools. The U-shaped handle *C* was made of 3/8-inch stock, and was driven into holes drilled at each end of piece *B*. The holes for the handle were drilled close to the sides of the holder *A*, in order to keep the eccentric groove in a central position.

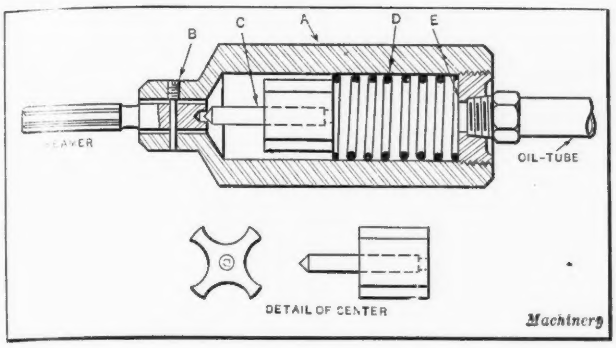
When a tool is to be inserted in the holder, the handle *C* is placed in the position shown in the illustration, and the tool is forced back into place, with the tang entering the deepest part of the eccentric groove. To remove the tool, the handle *C* is swung forward causing the eccentric member *B* to rotate and force the tool out. Taper-shank tools can be removed quicker by this means than with drifts, the holder is not mutilated, and there is no jarring of the turret, as is the case when a hammer is employed to force the tool out with a drift or wedge.

Montreal, Canada NORMAN MOORE

REAMER-HOLDER FOR AUTOMATIC SCREW MACHINE

The accompanying illustration shows a reamer-holder that has been used successfully to remedy trouble sometimes encountered in automatic screw machine operation. It is not unusual for one operator to have charge of several machines, and it often happens that while an adjustment is being made on one machine another develops trouble, which may not be noticed immediately. The special reamer-holder here described was developed by the writer for use on a Gridley multiple-spindle automatic screw machine, employed in the manufacture of small tool-steel bushings. The operations were: Spot-center in the first position, drill in the second, and ream in the third.

The hole in the work was deep and of small diameter. The drills were broken frequently due to the small diameter, the hardness of the material, and the high rate of production. If the operator saw such an accident, he could shut down the machine and replace the drill without further damage. Often, however, he was occupied elsewhere, and the work with part of the broken drill was carried to the reaming station, where the reamer would also be broken when fed against the unyielding end of the broken drill.



Safety Reamer-holder for Automatic Screw Machine

Referring to the illustration, the body A of the reamer is provided with a shear pin B, which is threaded and slotted at one end to facilitate replacement. Within the body of the holder is a centering head C, backed up by a spring D. The conical end of the centering head is forced against the center of the reamer, which causes the reamer to float in a central position. Spring D is held in place by screw E, which is tapped to receive the oil-tube. The oil flows through the openings in head C and around the reamer in such a manner that it is directed into the hole being reamed. When the reamer is fed against the fractured end of a broken drill, pin B is sheared off and the reamer forced back, compressing spring D within the holder. While the work is being indexed to the next station, spring D ejects the reamer from the holder, allowing it to fall into the work-pan.

This fixture is also adapted to single-spindle automatic screw machines by eliminating the oil connection.

Pittsburg, Pa. LAWSON SHAW

GAGES FOR CHECKING PLANING OPERATIONS ON LATHE BED

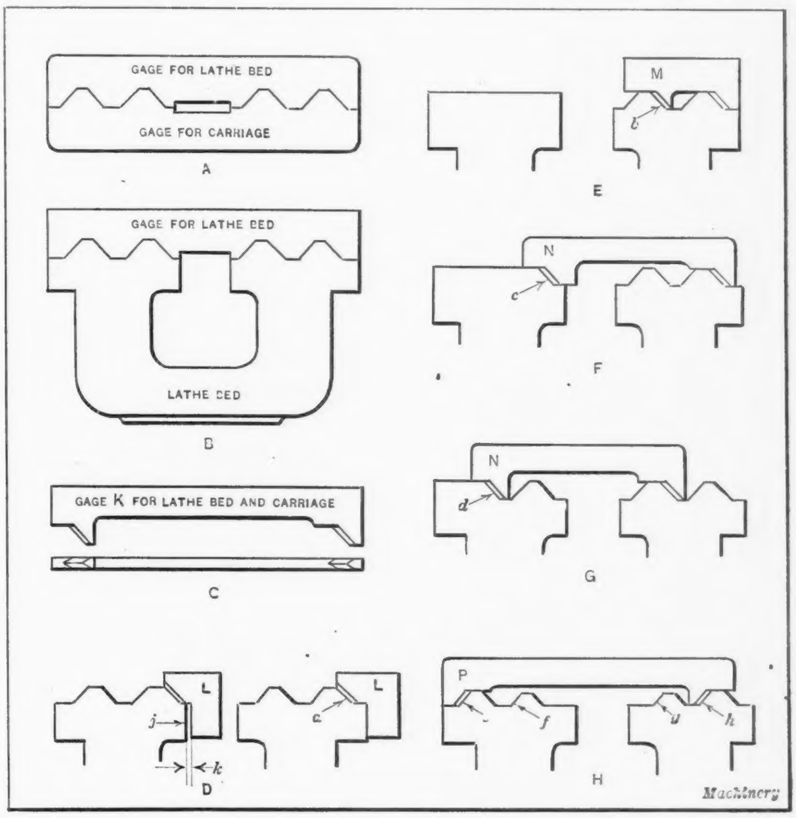
The cost of scraping and fitting the V-ways of machine tools depends on the accuracy with which the ways are planed or milled. Thus the cost of hand fitting can be reduced by increasing the accuracy of the machining operations. At A in the accompanying illustration, is shown a set of gages of the type generally used to check the accuracy of the planing or milling operations on the V-ways of a lathe bed and carriage. Gages of this kind are intended for the final inspection of the work after the machining operations are completed, as indicated at B.

The machinist needs gages that will permit him to check the accuracy of each surface machined as the work progresses. For this purpose, a set of gages was made up for use in one plant. The gages and the methods of using them are shown at C, D, E, F, and G. After the lathe bed to be machined is lined up and clamped to the planer table, the swivel tool-head of the planer is set at an angle of 45 degrees. A cut is taken on surface a, view D. After this surface has been planed down to size, as indicated by the gage L, the surface b, view E, is machined without changing the setting of the tool. The accuracy of this operation is checked by using gage M.

The surface c, view F, is next machined, being gaged for accuracy by gage N. The next surface to be planed, which is shown at d, view G, is checked by using the same gage N employed in checking surface c.

One advantage of these gages is that they can be used for checking the carriage as well as the lathe bed. The surfaces e, f, g, and h, are planed and gaged or checked in the same manner as the first four surfaces, the gage P being used when the middle V-ways are lower than the side V-ways, in the manner shown in view H. The position of the V-way surfaces with respect to the finished surface j, view D, may be determined by using thickness gages in the clearance space k, thus obtaining the depth of the last finishing cut.

New York City DAVID H. SINGER



Method of gaging Lathe V-ways

INSPECTING LARGE RADIUS GAGES

The writer is employed by a ball bearing manufacturing concern, and in the course of his work, has been called upon to check the accuracy of large radius gages of the types shown in Figs. 1 and 2. In such inspections, he first solders the gage and two pieces of drill rod S to a surface plate as shown, the drill rod being, of course, faced off square on the end fastened to the surface plate. A parallel Z is then placed tangent with the drill rods, after which distance B, Fig. 1, from one face of the parallel to the top of the arc of the gage can be measured by means of precision gage-blocks and a plug gage applied as shown. In the case of the gage illustrated in Fig. 2, dimension E is determined merely by the use of gage-blocks between the parallel and the gage.

After determining dimension B of the gage illustrated in Fig. 1, the radius of the gage can readily be determined by the formula

$$R = \frac{1}{2}\left[\frac{(A+D)^2}{4(B-D)} + B\right]$$

in which

R = radius of gage;
A = distance between the drill rod pieces;
D = diameter of the drill rod pieces; and
B = height between parallel and upper point of gage arc.

The radius of the other type of gage, illustrated in Fig. 2, can be determined by the formula

$$R = \frac{1}{2}\left[\frac{(L-D)^2}{4(D-E)} - E\right]$$

in which

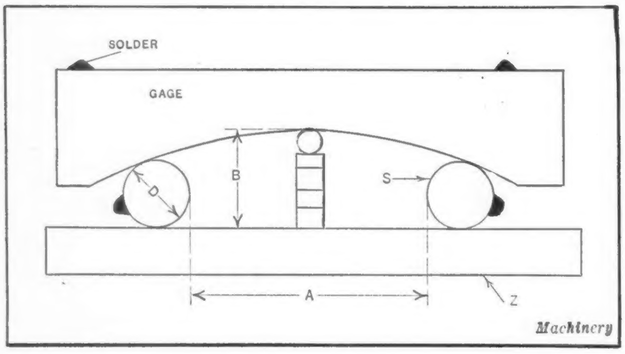


Fig. 1. Taking a Measurement on a Gage preparatory to calculating its Radius

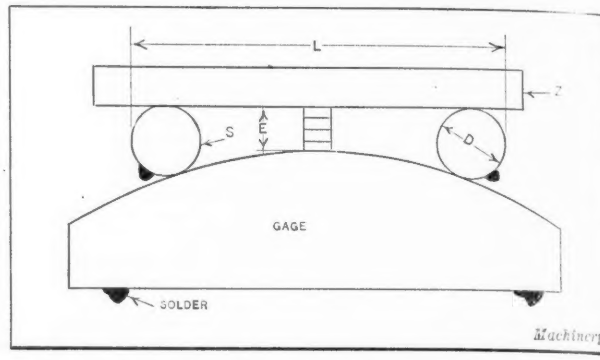


Fig. 2. Finding Dimension E on a Different Type of Gage before determining the Radius

R = radius of gage;
L = distance over the drill rod pieces;
D = diameter of the drill rod pieces; and
E = height between the parallel and the upper point of the gage arc.

The derivation of these formulas will probably be of interest; by referring to Fig. 3, the derivation of the formula used in the case illustrated in Fig. 1 can be readily followed. In the triangles CGF and FGK,

$$CG : FG = FG : GK \quad \text{or} \quad CG = \frac{FG^2}{GK}$$

and

$$KI = 1/2\ D = GH$$

Therefore,

$$GK = B - D$$

and as

$$FG = 1/2\ (A + D)$$

$$CG = \frac{1}{4} \frac{(A+D)^2}{B-D} = \frac{(A+D)^2}{4\ (B-D)}$$

Now,

$$CE = 1/2\ D = GH \text{ and } CG = EH$$

Hence:

$$R = 1/2\ (EH + HI) = 1/2\ (CG + B)$$

or

$$R = \frac{1}{2}\left[\frac{(A+D)^2}{4\ (B-D)} + B\right]$$

From Fig. 4 the derivation of the formula used with the gage shown in Fig. 2 can be readily followed. In the triangles ABF and FBH,

$$AB : FB = FB : BH \quad \text{or} \quad AB = \frac{FB^2}{BH}$$

$$FB = 1/2\ (L - D)$$

$$HC = KB = 1/2\ D - E$$

and

$$BH = HC + KB + CK = D - 2E + E = D - E$$

Thus,

$$AB = \frac{[1/2\ (L-D)]^2}{D-E} = \frac{1}{4} \frac{(L-D)^2}{D-E} = \frac{(L-D)^2}{4\ (D-E)}$$

Now, $MA = CB$, because they both equal $1/2\ D$, and $MC = AB$. Hence:

$$R = 1/2\ (MC - E) = 1/2\ (AB - E)$$

Substituting the previously found value for AB,

$$R = \frac{1}{2}\left[\frac{(L-D)^2}{4\ (D-E)} - E\right]$$

Philadelphia, Pa. CHARLES KUGLER

* * *

Through the efforts of the standardization committee of the American Society of Mechanical Engineers, representatives of the leading manufacturers of opening die-heads and chasers were recently brought together at the headquarters of the society. Upon comparison of their stock lists, these manufacturers found that they could cut down their lists from over 2000 varieties of chasers to about 200. This standardization will follow the American (National) Standard Screw Thread recommendations except in a few instances where odd shapes and pitches are widely used.

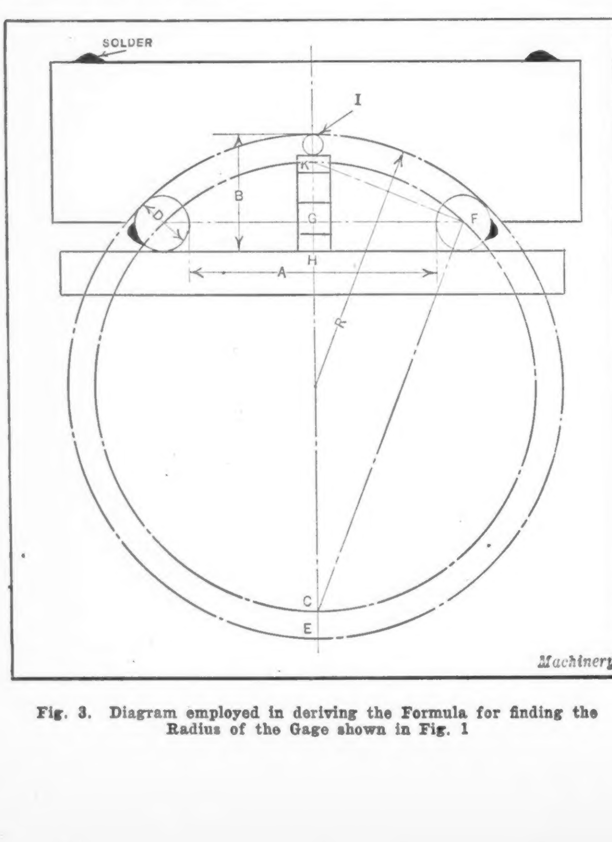


Fig. 3. Diagram employed in deriving the Formula for finding the Radius of the Gage shown in Fig. 1

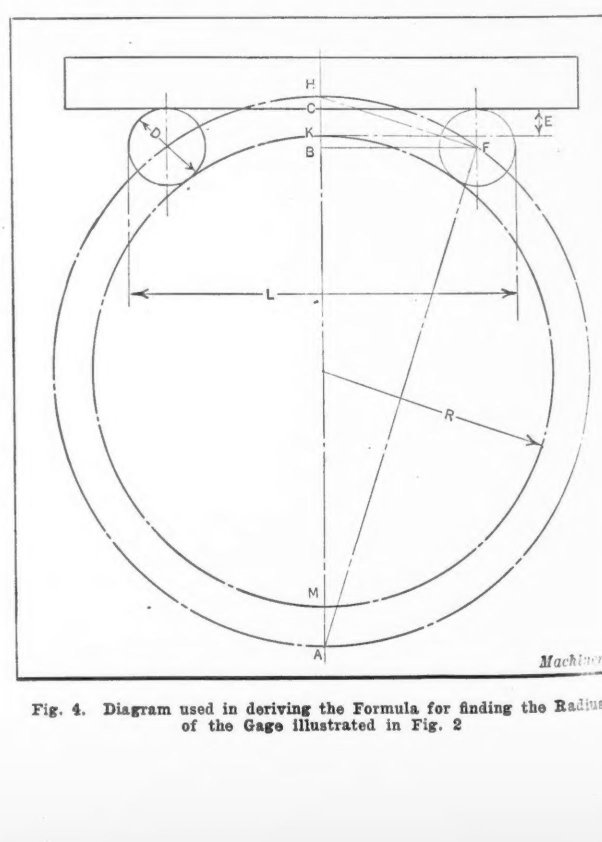
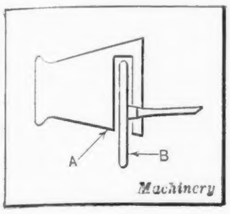


Fig. 4. Diagram used in deriving the Formula for finding the Radius of the Gage illustrated in Fig. 2

Shop and Drafting-room Kinks

ADAPTING JEWELER'S EYE-GLASS TO SPECTACLES

It is usually difficult for a man who wears spectacles to use a jeweler's eye-glass for fine optical or instrument work. If the spectacles are removed, the vision is usually impaired. This condition can be overcome by cutting a slot in the holder *A*, so that the eyeglass can be placed over the lens *B* of the spectacles. This method of holding the eye-glass permits it to be easily removed without disturbing the spectacles.

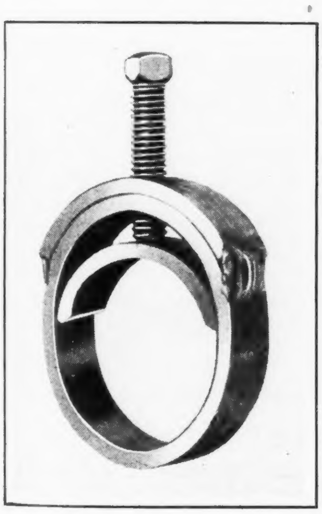


Jeweler's Eye-glass attached to Spectacles

JOHN F. HARDECKER
Philadelphia, Pa.

CLAMP MADE FROM BOILER TUBING

Difficulty experienced in obtaining ready made clamps of the required size and strength for certain kinds of work led to the construction of special clamps like the one illustrated. The particular clamp shown was made from a ring 1 inch wide cut from a piece of 2-inch boiler tubing. The ring was flattened on the sides to give it an oval shape. A reinforcement made from a section of a similar piece of tubing was then fitted snugly around one end of the flattened ring, and the ends of the reinforcing section welded to the sides of the oval-shaped section by means of an oxy-acetylene welding blow pipe. A 5/16-inch hole was drilled through the top of the reinforced section, and the hole tapped to receive a set-screw. The shoe of the clamp was also made from a piece of boiler tubing 1 inch wide. A spot or countersink was made in the top of the clamping shoe to receive the point of the set-screw. Clamps made in this manner can be adapted to work of different sizes by flattening the oval-shaped member as required.



Clamp made by welding together Pieces of Boiler Tubing

New York City O. P. WILLIAMS

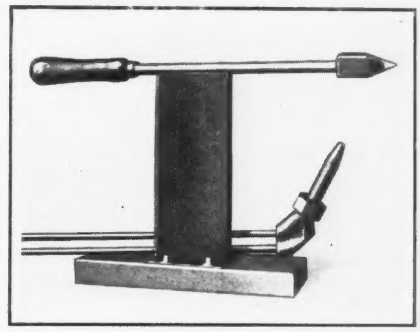
METHOD OF MAKING SMALL BLUEPRINTS

Draftsmen often wish to make small blueprints for loose-leaf books or data sheet files. If a small blueprint frame is not available, a good substitute can be made as follows: A piece of celluloid slightly larger than the required blueprints is obtained, and a piece of heavy, flexible cardboard is used to back up the blueprint paper. The blueprint paper is then inserted between the celluloid and cardboard, and is held by two rubber bands which are passed over the ends of the cardboard. The cardboard, blueprint paper, tracing, and sheet of celluloid should bulge outward toward the sun when the rubber bands are in place. This will cause the celluloid to bear tightly against the blueprint paper so that a good print will be obtained.

Trenton, N. J. EDWARD LARUE

COMBINATION HOLDER FOR TORCH AND SOLDERING IRON

A simple and easily constructed device for holding an acetylene torch and a soldering iron in such a position that the flame from the torch will be directed on the soldering iron is shown in the accompanying illustration. The holder consists essentially of a rectangular base made from a piece of bar stock, or a casting, and two right-angle strips of flat steel secured to the base with machine screws. The distance between the upright strips is equal to the diameter of the torch tubes, so that when the torch is placed between them it is held in a position that directs the flame upward. The shank of the soldering iron should be larger in diameter than the torch tubes so that it will rest on top of the uprights. In the shop where this holder is used, a piece of tubing was slipped over the shank of the iron to prevent it from sliding down between the upright pieces.



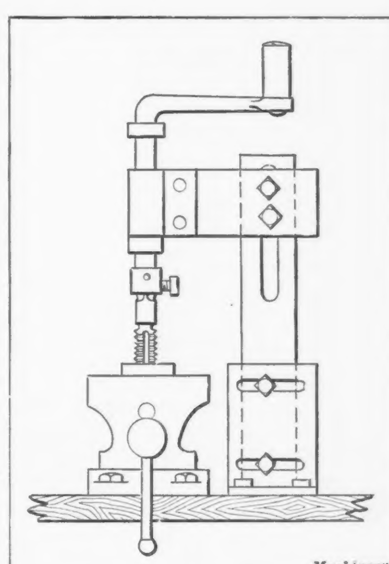
Combination Holder for Soldering Iron and Acetylene Torch

Rosemount, Montreal, Canada HARRY MOORE

BENCH FIXTURE FOR TAPPING

The work of tapping holes in nuts, plates, or small parts in quantities can be sped up by means of a bench fixture such as shown in the accompanying illustration. The tap is held in a vertical or horizontal position by means of the bracket. A holder or socket that forms part of the shaft supported in the bracket serves to hold the tap. A handle provided with a wooden grip is secured to the upper end of the shaft that holds the tap. The fixture is made adjustable for convenience in setting up for different jobs and is placed adjacent to the vise in which the work is held.

When set up as shown, the fixture keeps the tap in a vertical position directly over the hole to be tapped. The tapping spindle is rotated by one hand, so that the workman is permitted to use his other hand to oil the tap and brush away the chips. Aside from cutting down the time for tapping about one-third, the fixture eliminates much of the tap breakage and prevents holes from being tapped at an angle or out of line.



Tapping Fixture used with Bench Vise as Work-holder

G. A. LUERS
Washington, D. C.

Questions and Answers

MILLING A RECTANGULAR BLOCK

H. A. R.—Fifty rectangular pieces of the dimensions shown in Fig. 1 are required to be milled accurately to size. It is desirable to hold the work in a milling machine vise, but some difficulty has been experienced in obtaining the required accuracy when this means of holding the work has been employed for similar pieces. Will some one please explain the proper methods and sequence of machining operations required to finish the four sides *A*, *B*, *C*, and *D* of the block?

ANSWERED BY S. W. BROWN, PAWTUCKET, R. I.

Rectangular parts like the one shown in Fig. 1 should be held in the milling machine vise and milled by a spiral milling cutter mounted on an arbor supported by the hanging arm. The first step is to procure a sharp spiral milling

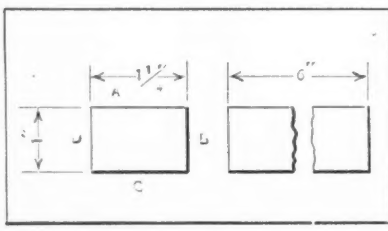


Fig. 1. Rectangular Block to be machined

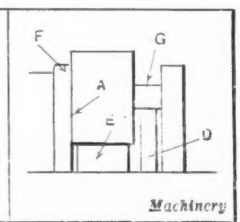


Fig. 2. Method of holding Block in Vise

cutter of uniform diameter throughout its length. The jaws of the milling machine vise should next be tested for straightness and squareness. A test indicator clamped between the arbor collars can be used to advantage in testing the accuracy of the vise.

Assuming that the tests show that the vise jaws are square and straight, the surface *A* is milled by clamping the work in the vise. Surface *A* is then located against the fixed jaw of the vise and the two adjacent surfaces *B* and *D* milled in succession, after which surface *C* is milled. A mistake commonly made in milling rectangular pieces is to mill two opposite surfaces first. The fixed vise jaw should be considered as a true surface at right angles with the surface of the milling machine table.

In Fig. 2 is shown an end view of the work resting on a parallel *E*, with the surface *A* located against the fixed jaw *F*. In order to insure accurate location of the work, a small parallel *G* is interposed between the work and the movable jaws. A round rod may sometimes be employed in place of the small parallel. The parallel *D* is simply a support for the parallel *G*. In any case where a finished surface rests on a parallel such as indicated at *E*, the work should be given a few light blows with a soft hammer in order to insure proper seating of the work before proceeding with the milling operation.

GROWTH OF CAST IRON

J. S. D.—I have noticed that a cast-iron annealing oven that has been in use for some time appears to have increased in length. While I am aware that cast iron often "grows" when subjected to repeated heatings, it does not seem possible that the change in the length of the oven from this cause would be noticeable. To what extent has this quality of cast iron been known to affect the dimensions of castings?

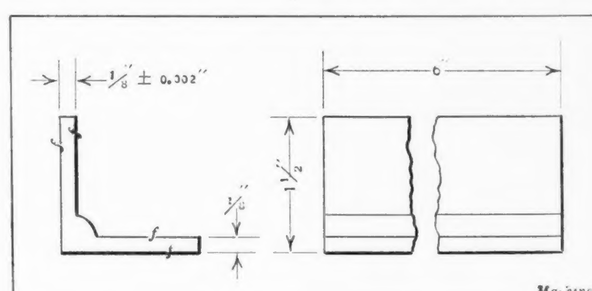
A.—The fact that certain kinds of cast iron will "grow" after repeated heatings has long been known by engineers. In one instance a cast-iron annealing oven 8 feet in length, 3 feet in diameter, with a wall thickness of 1½ inches, which was kept red-hot for prolonged periods, between which it was allowed to cool off, grew to a length of 9 feet. Some tests performed on a cast-iron bar 1 inch square by 14 13/16 inches in length resulted in the length of the bar being increased to 16½ inches. The sides of the square forming the cross-section of the bar also increased from 1 to 1⅛ inches. In this case the bar was heated twenty-seven times to a temperature of about 1470 degrees F. for one hour. Twelve additional heatings increased the dimensions of the bar until the total cubical expansion was approximately 45 per cent. In cases where the "growth" of cast iron is objectionable, white iron should be used instead of gray iron.

MILLING OPERATIONS ON ALUMINUM CASTING

R. C. B.—A lot of 100 aluminum castings like the one shown in the accompanying illustration are required to be milled on the surfaces bearing finish marks. Will some reader of MACHINERY who has had experience in milling work of a similar nature describe suitable fixtures and tool equipment for this job?

ANSWERED BY T. D. JOLLY, CHESWICK, PA.

The solution to this problem given on page 230 of November MACHINERY is entirely correct, but the writer believes that there is a method by which the pieces may be produced at lower cost. If the pieces are made from aluminum castings, there must be an allowance of at least 1/16 inch for finishing on each surface, and as the finished thickness is only 1/8 inch, this means that approximately as much metal



Aluminum Casting to be machined

is removed as is left on the flange. At least one special cutter and two operations are required to mill both flanges of the part.

As the piece is machined all over, except for the fillet section, it is likely to become warped. A certain number of pieces will also have to be scrapped because of defective castings, pits, or sand holes. The foundry will, of course, replace such castings, but such replacement does not compensate for the expense of the machine work performed before the defects are discovered.

In view of these facts, the writer believes that it would be much better and cheaper to make the pieces from extruded aluminum bars. A comparatively inexpensive die is the only special equipment required for the extrusion process. The extruded bars come from the die smooth, straight and true to size within close limits. The only machine work required is to saw the bars off to the desired lengths. When this method is employed, there is no scrap metal except that removed by the saw, and the extruded metal is stronger and has a better finish than machined sand castings. When parts of this kind are required, the writer believes that it is always well to make a comparison of the two methods described before proceeding with the actual production work.

Improvements Needed in Automotive Steels*

By WALTER G. HILDORF, Metallurgist, Reo Motor Car Co., Lansing, Mich.

EVERYONE who has had experience with automotive steels has been confronted with problems, many of which have never been solved; hence, these troubles recur periodically, frequently involving an enormous expense until the particular heat of steel is used up. The aim of this article is to attempt to throw some light upon these baffling problems in the hope of bringing about their solution through the cooperation of the steel companies.

In general, the main problem, at least for the present, is to obtain greater uniformity from heat to heat, rather than to attempt to produce new steels. It should be possible to obtain heat after heat of the same steel, which could be forged, treated, and machined alike; it should also be possible to use a standard heat-treatment and obtain hardness and physical properties within the limits usually allowed for that particular steel. The following references to the improvements needed are given with a full realization of the fact that the steel men have their troubles. The quality of their raw materials is a variable factor, the temperature at which they work is very high, involving many difficulties, and the pouring and rolling offer still more problems. In addition, present-day metallurgy is so new that metallurgists do not agree on all specifications. However, difference of opinion is one of the penalties of progress, for if everything were standardized and everyone agreed, there would be no progress. In spite of difficulties and differences of opinion, the automotive industry should have a higher quality and more uniform steel to meet the present-day requirements. The demands are more exacting and the service more severe than in the past; for example, the last member of the family —the bus—probably receives more severe service than any other, because it must run at passenger car speed, with a truck load, in all kinds of weather and often over very bad roads.

Fig. 1. Example showing Fully Silky Fibrous Fracture

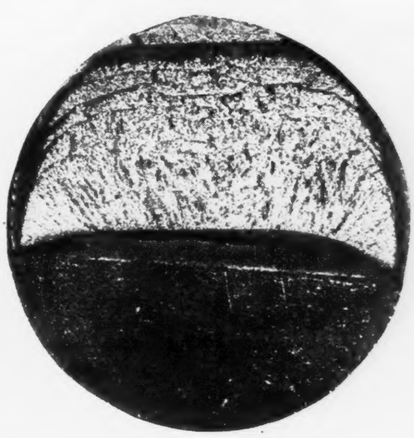


Fig. 2. Fracture showing Crystalline Structure

Fig. 3. Fracture showing Reedy or Woody Structure

Inspection Should Disclose Seams and Soft Centers—Chemical Analysis does not Tell the Whole Story

In so far as the fabrication of steel is concerned, seamy stock probably causes the most trouble in the drop-forge plant. Inspection methods should be such that no seamy material leaves the steel mill for use in parts where seams would be objectionable, as in gear forgings.

The grain structure in steel should be uniformly dense, in order to have uniform strength, hardness, resistance to wear, and freedom from warpage. Spongy centers are usually more pronounced in the larger pieces; die-blocks for example, often have spongy spots which will wear much faster than the more dense parts of the block.

Steel mills meet chemical analysis requirements, but the chemical analysis tells only part of the story. The chemist determines whether the steel has the correct amounts of such elements as carbon, manganese, nickel, etc., but he does not tell us if it contains a dangerous amount of foreign matter, such as manganese sulphide, oxides, or slag. To use the common term, he does not tell us whether the steel is dirty or not.

The steel companies ought to be able to furnish steel without large non-metallic inclusions. However, it is not possible to make steel entirely free from minute inclusions, because it would be practically impossible to keep the bath molten and quiet for a long enough time to allow their separation. In justice to the steel companies, it should be said that there has been considerable improvement in the cleanliness of steel; yet the average steel is not so clean as it should be.

Normal and Abnormal Steels

The terms "normal" and "abnormal" are generally used to differentiate between a steel that will harden 100 per cent hard and a steel that will have soft spots after hardening in the ordinary way, without the use of cyanide or salt baths. It has been demonstrated that it is often possible to harden an abnormal steel 100 per cent hard by the use of cyanide or salt baths. The Bureau of Standards has investigated this, and states that quenching experiments of carburized normal and abnormal steels indicate that abnormal steel is more prone to give soft spots than normal steel. A large number of steel mills can furnish normal steel, and it would seem desirable to use this steel rather than abnormal steel, because it would not be necessary to use salt or cyanide baths for hardening. In other words, if one already had furnaces that were heated with oil, gas, or electricity, they could be used successfully for hardening normal steel, but would not give satisfactory results with abnormal steel.

The Reo Motor Car Co. has used normal steel since about May 1, 1921, and has obtained very satisfactory results as to warpage and hardness using either oil, gas, or electricity for

*Abstract of a paper presented before the annual convention of the American Gear Manufacturers' Association at West Baden, Ind.

heating. The following routine is followed in checking steel for normality.

1. The steel is carburized at 1700 to 1725 degrees F. for eight hours, using a carburizing material that will give a case containing considerable excess cementite.

2. The boxes are removed from the furnace and the samples are allowed to cool in the box.

3. A section of the sample is cut out with a hacksaw.

4. The sample is polished and then etched with 3 per cent nitric acid in alcohol or 5 per cent picric acid in alcohol.

5. A microscopic examination is then made of the case, the junction of the case and core, and the core.

6. The magnification was 100 on all except cases of alloy steels, where it was necessary to use 425 in order to bring out the structure so that it was sharp or plain and comparable with the photomicrographs obtained on other steels.

Warpage of Abnormal Steel

Much has been written concerning the soft spots obtained when abnormal steel is hardened in the usual way, but little if anything has been written regarding warpage, although it seems always to accompany the abnormal condition in steel. This can be easily checked by making simple shapes of both the normal and abnormal steels, and checking them for warpage after hardening. One of the best checks that we have ever had was with an abnormal heat of S. A. E. No. 2315 steel which had been made into rear axle ring gears. The normal steel had an average hardness of 80 to 85 scleroscope. The abnormal steel had a hardness of 60 to 80 scleroscope and warped much more than the normal steel. Twenty-five of the gears were marked and put aside on the gear floor, where they were kept until the normal steel had been in use for about two weeks. Then these gears were mixed with the regular gears and sent to the heat-treating department, after which they were inspected for hardness and warpage. The inspectors, without any knowledge of the fact that these gears were coming, scrapped twenty-four out of the twenty-five gears.

This phenomena of warpage can probably be explained as follows: When soft spots are examined under the microscope, it is found that their structures are troostitic or a combination of troostite and sorbite. In other words, these soft parts have gone through a greater expansion than the harder parts, and therefore would cause warpage.

Comparison of Normal and Abnormal Steels

Fig. 4 shows the case of a normal S. A. E. No. 1015 steel. Note the sharp, definite grain boundaries. This steel hardened 100 per cent hard when heated in an electric furnace and water-quenched. It had a sclerescope hardness of 95 to 105. The case of an abnormal S. A. E. No. 1015 steel is shown in Fig. 5. Note the partially broken down grain boundaries. When heated in an electric furnace and water-quenched, 20 per cent of its surface was soft. The hardness varied from 60 to 95 sclerescope. The case of a much more abnormal steel is shown in Fig. 6. Here the grain boundaries are completely broken down. When heated and quenched the same as the steels shown in Figs. 4 and 5, fifty per cent of its surface was soft. The hardness varied from 45 to 90 sclerescope. The pieces shown in Figs. 4, 5, and 6 were etched with 3 per cent nitric acid in alcohol.

The core was not shown in the preceding photomicrographs, because it is believed that the core structure or grain size is not a reliable indication as to whether a steel is normal or not. In deciding whether a steel is abnormal or not, the decision is based entirely upon the condition of the excess cementite in the case. If the excess cementite exists as a sharply defined network, the steel is classed as a normal steel. The condition of the pearlite grains seems also to serve as a fairly reliable indicator of this condition. The abnormal condition does not seem to be confined to any particular class or type of steel. It has often been found in such steels as S. A. E. No. 5140 and S. A. E. No. 3140. Since abnormal steel is more likely to have soft spots and cause trouble from warpage than normal steel, the steel companies would do a wonderful service to the automotive industry if abnormal steels could be eliminated.

Fracture Testing of Steel

Steel makers have fractured steel for many years for the purpose of judging its condition or quality from the appearance of the freshly broken surface. However, most of this has been done to aid in the manufacture of the steel, and no one seems to have tried to connect the appearance of the broken bars with their impact or fatigue properties. It is well known that it is possible to obtain easily the usual physical properties, such as tensile strength, elastic limit, reduction of area, and elongation. This is because the steel companies and the automotive metallurgists have cooperated to solve the problem. However, automotive parts are subjected to impact and fatigue—two properties about which very little is known. If a careful inspection is made of parts that have failed in service, such as axle shafts, the fractures of these parts will doubtless throw considerable light upon their impact and fatigue values. There is no generally accepted fatigue machine which can be depended upon to give results that would be comparable to those obtained in service.

To explain the fracture method of inspection, the routine followed for axle shaft material (S. A. E. No. 3140) will be given. Three bars, 9 inches long, are taken from each heat of steel. They are heated to 1550 degrees F. in an electric

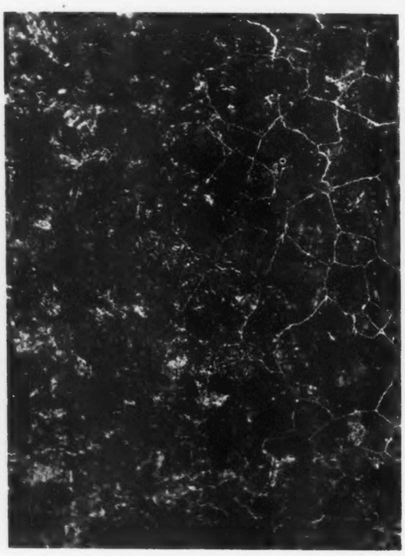


Fig. 4. S. A. E. No. 1015 Steel with Normal Case. Note the Sharp, Definite Grain Boundaries

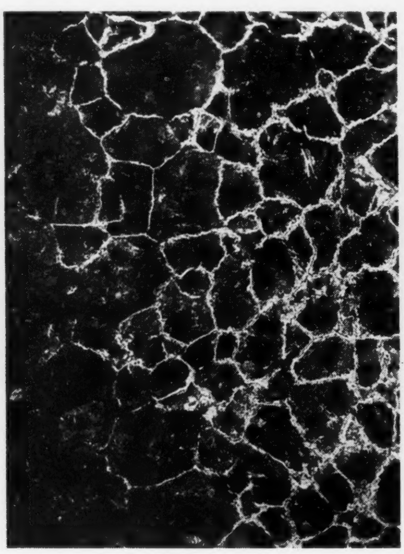


Fig. 5. S. A. E. No. 1015 Steel with Abnormal Case. Note the Partially Broken Down Grain Boundaries

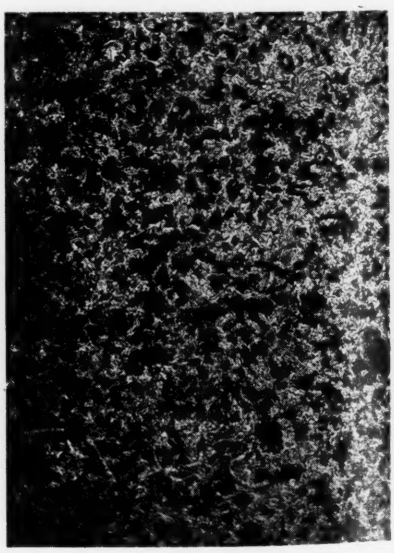


Fig. 6. S. A. E. No. 1015 Steel having a Very Abnormal Case, the Grain Boundaries being Completely Broken Down

Fig. 7. S. A. E. No. 3140 Steel having a Large Grain Structure

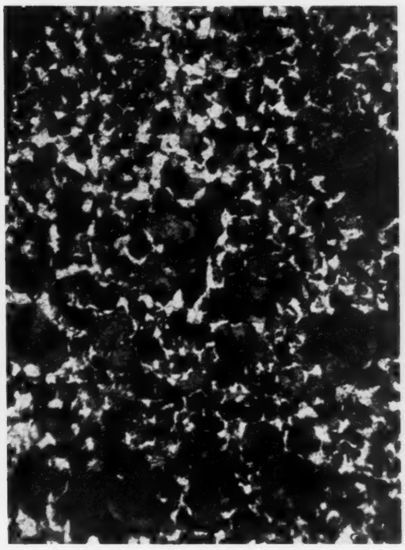


Fig. 8. S. A. E. No. 3140 Steel having a Medium Grain Size

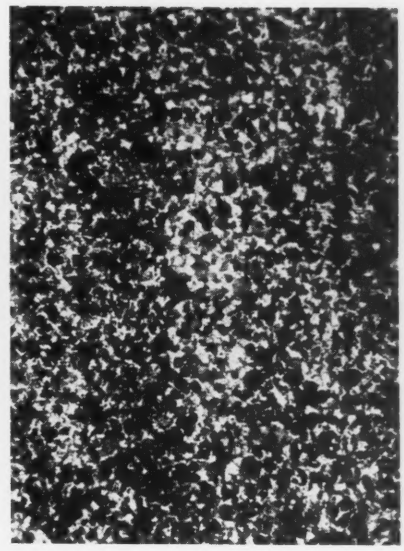


Fig. 9. S. A. E. No. 3140 Steel having a Small Grain Size

furnace, held at that heat for one and one-half hours and cooled in the air. Then they are heated to 1425 degrees F. in the same or a similar furnace, held at that heat for one and one-half hours, and furnace cooled. When the bars have cooled to room temperature, they are notched at the center. This notch is made by cutting the bar about one-third off with a hacksaw. The bars are broken in a press by placing the bar notch down on two V-blocks which support it at the ends. A narrow block is placed on the bar opposite the notch, and pressure is applied slowly to this block until the bar is broken.

Characteristics of Different Fractures

The desired fracture is shown in Fig. 1, and is called "fully silky fibrous." A bar with this kind of fracture is very tough and seems to be of equal strength over the whole cross-section, because the threads or fibers of the steel break together without causing cracks or bursts in the bar. The fracture of a very brittle bar is shown in Fig. 2. This has been called a "crystalline structure." It is probably the most dangerous structure that can be put into an automotive part that must resist shock and fatigue. This structure is often found in the regular run of S. A. E. No. 3140, as well as several other, if not all, steels.

The ordinary heat-treatment will not make such steel tough. As an example, an electric furnace steel was given four heat-treatments, any of which should have caused the bar to break with a tough fracture, provided it would respond to heat-treatment and become tough. However, it was found necessary to quench from 1800 degrees F., then quench from 1475, and finally furnace cool from 1475, in order to make the steel break with a tough fracture. Such material as this is not safe to use for highly stressed parts, because even when it broke with a tough fracture, it was very weak in comparison with a bar such as shown in Fig. 1.

Another fracture that is often found is shown in Fig. 3. In this "reedy" or "woody" fracture, the tears or bursts vary decidedly in different samples, from a few minute cracks to those shown. Some of them are no doubt caused by dirt or laminated structure. It seems reasonable to believe that where these tears or cracks take place and the metal pulls out and apart, there is not uniform strength across the whole section; therefore, its impact and fatigue value should be lower than that of a fully fibrous bar. This has been fairly well substantiated by road tests and laboratory impact tests. This fracture test will also detect piped bars.

A large number of samples have been examined under the microscope in an attempt to find something that would differentiate between the various fractures such as fully fibrous, crystalline, and reedy or woody. So far, nothing has been found that could be depended upon to separate them. Possibly the main reason for this is that they all go back to or are dependent upon the conditions under which primary crystallization took place. When a comparison is made of bars having the fractures mentioned, and all are of the same Brinell hardness, it is found that they all machine alike except the crystalline bar which machines much harder. On such operations as milling splines or keyways, difficulty will be encountered in maintaining the size, if the limits are close and the stock is mixed.

From practical tests extending over a period of several years, it appears that there is an enormous difference in the fatigue and impact values of bars with different fractures. Several steel companies can meet this specification, and it is hoped that more of them will do fracture testing, with the result that fully silky fibrous bars will become the rule rather than the exception.

Grain Size

The matter of grain size rarely enters into a steel specification, except in such cases as specifying "large grained normal steel" before we knew that we should specify "small grained normal steel;" yet the grain size varies enormously from heat to heat, and to a somewhat lesser degree in the same heat. It does not seem possible by heat-treatment to bring grains of different samples to the same size and keep them the same.

Some samples of S. A. E. No. 3140 steel were placed in a carburizing box and heated for eight hours at 1700 degrees F. and then cooled in the box. The core or center of three samples are shown in Figs. 7, 8, and 9. The photomicrographs were taken at a sufficient depth so that the structure was not affected by the carburizing of the exterior. These samples show a large variation in grain size, yet this variation is typical not only of S. A. E. No. 3140 steel, but of all the steels that have been examined. It is true, however, that some have an average grain size much larger than others, such as the carbon steels, while others have an average much smaller, such as the vanadium types of steels. But the point is that, regardless of whether the average grain is large or small, the variation seems to be greater than it should be in automotive steels.

The large grained steel is very likely to be brittle, many having found this to be the case in their experience with large grained normal steel. The large grains grow readily, while a small grained steel seems to change its grain size much slower, and as a result of this a single quench can be used for case and core refinement. In addition, it appears that the fine grained steel has a much wider hardening range.

The only objection so far found to small grained normal steel is that it seems to absorb carbon somewhat slower than a large grained normal steel of the same analysis; but the extra time is not very great.

CLEANING METAL PARTS IN AUTOMOBILE PLANTS*

By H. C. DUGGAN, Oakley Chemical Co., New York City

Many of the numerous cleaning jobs in automobile factories are similar, and for this reason the methods typical of each class of work and equipment employed, will be dealt with. Oakite cleaning solutions for pressed-steel and cast-steel parts are used in two distinct types of cleaning equipment. It is important to differentiate in the equipment, as a wide variation of concentration of the solutions is necessary in each type to obtain a high standard of cleaning at the lowest cost. Small and at times large concerns use the still tank method of cleaning. The large plants, with a production capacity warranting the cost of installation of a washing machine, generally use automatic metal washing machines equipped with continuous conveyors.

The Use of Still Tanks

Still tanks are used on small parts, such as heaters for automobiles, channels for windows, hub flanges, etc. The pressed-steel parts have a drawing compound covering, along with the rust preventive which has been placed on the steel at the mills, while the cast-steel parts usually have only a cutting oil covering. In nearly every case, the cleaning compound used for this work can be employed at a strength varying from two to six ounces per gallon of water at 200 degrees F. In one exceptional case of an unusually difficult piece of work, it was necessary to use a solution containing two different cleaning materials. This was on cold-rolled sheet-steel stock used for window channels, which was covered with a thin film of paraffin oil. All parts are hot rinsed, if the operation is followed by an enameling or Parkerizing process.

Automatic Washing Machines

Automatic washing machines do excellent work on such parts as fenders, running board aprons, disk wheels, brake drums, fans, cylinder blocks, oil pans, etc. One-third ounce of material per gallon is the average for such work. Bolts and nuts are also cleaned efficiently in baskets run through automatic washing machines. Such parts are usually heavily coated with grease, and when packed close together, in several tiers deep, it takes a large volume of an effective solution to clean at a strength of from one-third to one ounce per gallon. In a washing machine the solution does not need so much cleaning material as in a still tank.

The cleaning action of the revolving-spray type of machine is aided by the force with which the solution is sprayed on the parts to be cleaned. The sprays are usually located above and below the conveyor which carries the work. For special work, however, they are located on the sides of the machine. One-third ounce of a good cleaning material per gallon does excellent work in such machines.

The paddles on the sides of the paddle-type washer pick up the washing solution and throw it over the work on the conveyor in torrents. This creates a considerable agitation, causing certain solutions to foam. A non-foaming cleaner at a strength varying from one-third ounce to one ounce per gallon is the best for this type of machine.

Sometimes the washing equipment consists of a stationary spray system. There is seldom any trouble with foaming in this case. The best material to use when no foaming occurs is the material that would foam under stronger agitation or when used in larger quantities.

Rinsing in the Washing Machine

Washing machines usually have a rinsing compartment when the following operation is enameling or japanning. There are cases, however, where a washing solution of one-third ounce per gallon is followed by enameling. This should never be practiced where it is possible to rinse, as a slightly stronger solution might cause subsequent trouble.

*From a paper read at the ninth annual sales conference of the Oakley Chemical Co., New York City, December 7 to 10.

A trouble often laid to the cleaning materials, when the washing operation is followed by enameling, is really caused by the lime in the rinse water. White spots are left on the metal where the drops of water dry off. These white spots are caused by lime in the rinse water. The only way to overcome this difficulty is to wipe each surface with dry rags before the metal has dried completely.

Cleaning after Heat-treating

A good cleaning material is very effective when used after oil quenching. This work requires a still tank with a boiling solution of at least eight ounces per gallon. If the parts, such as gears and ball bearing races, come to the cleaning solution before they have been allowed to cool, the grease may be removed in about thirty seconds. This will cause boiling, which aids considerably in loosening the grease. However, if this is impossible, as is often the case when the parts come through a revolving oil-tempering machine one by one, cooled oil-tempered parts may be cleaned by boiling them in the solution for thirty minutes. This time may be cut in half by adding two gallons of kerosene per every hundred gallons of solution.

Cleaning Screw Machine Products

Screw machine products are seldom rinsed after cleaning, because they must be kept immune from rust. Girls usually do the inspecting of such work, and when the parts are covered with a strong alkali material their hands become sore and cracked. If confronted by this difficulty, when cleaning is done in a still tank, the use of a solution containing four ounces per gallon of a mild cleaning material will obviate the trouble. The addition of one ounce per gallon of a film-producing material will help to prevent rust and also speed up the cleaning. When this difficulty is not encountered, the solutions mentioned for cleaning pressed-steel parts, are used.

Neutralizing Soldering Acids

Mild cleaning solutions are excellent neutralizers of acid or soldering flux. Care must be taken to destroy all trace of acid after the soldering operation, as corrosion would soon occur under the painted surface. One ounce per gallon of hot water will neutralize the average soldering job without leaving an objectionable white deposit. The parts on which this method is used are radiators, gasoline tanks, gasoline measuring devices, etc.

Preparing Steel Parts for "Duco" or Lacquer Finishing

The finish coatings on automobiles have undergone a marked change. One popular finish at present is known as "Duco." Other manufacturers of lacquers also have trade names for their products designed especially for the automobile industry. In applying this new type of finish, it is very necessary that the steel be absolutely free from grease. Disk wheels, hub flanges, small panels, etc., must be freed from all the oil and grease that they pick up in their fabrication. The parts, when rinsed after the washing operation, are entirely free from deposit.

Further treatment of the metal, where rust is likely to be encountered, as in automobile bodies, is taken care of by washing down with "Deoxidine" or some similar prepared rust remover. The body is then given a good washing with hot water and steam. The steam is used to evaporate as much of the water as possible, and also to clean out the crevices. To insure that every trace of moisture is removed, the seams and crevices are heated with a blow-torch. The metal is rubbed down with dry cloths, and the same procedure as in painting is followed.

Small refinishing shops, using paint remover on automobiles, experience trouble in lacquering, as they do not remove all traces of the paraffin wax used in the paint remover. An "Oakite" solution—one ounce per gallon of hot water—will clean this paraffin from the steel body and leave the surface in excellent condition for the lacquer primer.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

NORTON ROLL GRINDING MACHINE

One of the important features of a large roll grinding machine recently built by the Norton Co., Worcester, Mass., for the Munhall, Pa., plant of the Carnegie Steel Co., consists of a reversing motor for the drive of the wheel carriage. The mechanical reversing arrangement used in earlier models has been eliminated, resulting in a simplification of the drive. The machine is driven by four motors which have a combined rating of 70 1/2 horsepower. Rolls up to 54 inches in diameter and 21 feet in length can be swung over the bed, and so the machine ranks as one of the largest of this type ever built. In general construction, the machine closely follows one described in February, 1922, MACHINERY.

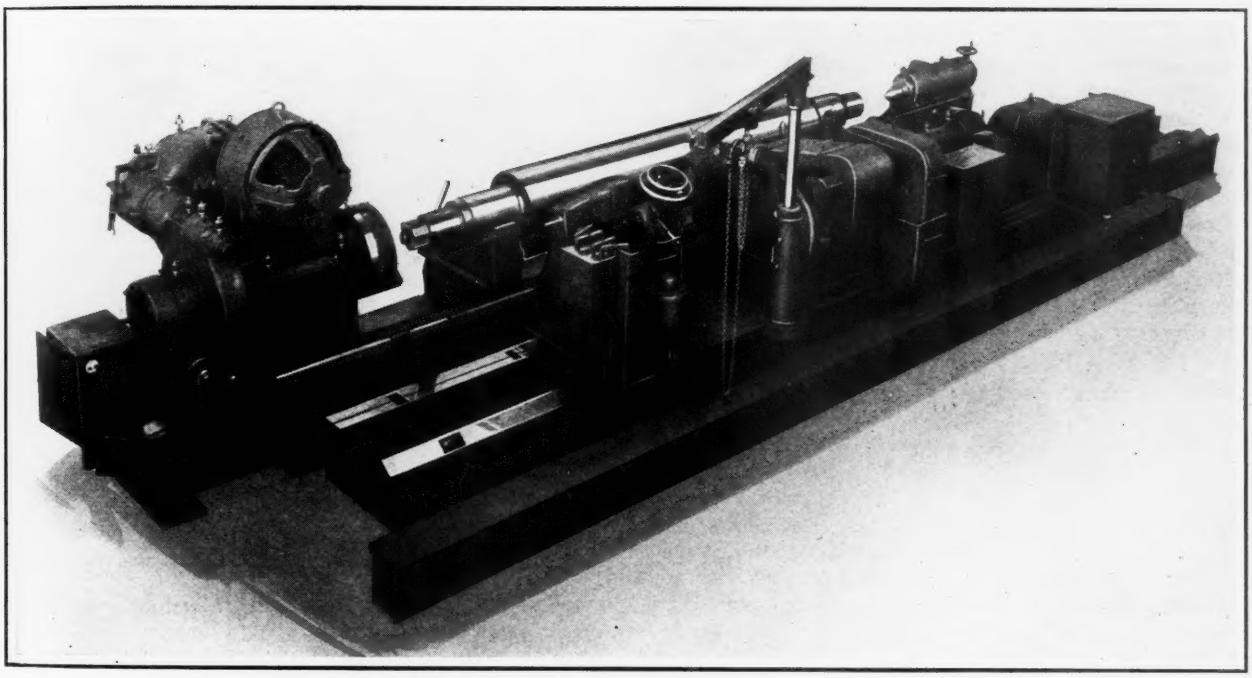


Fig. 1. Norton Roll Grinding Machine with Improved Features

The wheel carriage, which is the traversing member, is a self-contained unit on which are mounted the motors for traversing the carriage, driving the wheel, and operating the pump. A 7 1/2-horsepower adjustable-speed reversing motor operates the carriage, driving through a reduction box that is arranged to provide seven traverse speeds which meet all conditions. The motor and its control box are readily accessible for oiling or adjustments.

From the operator's position on the carriage, the contact of the wheel on the work is always visible. In front of the operator are handwheels for effecting the feed of the wheel and the hand traverse of the carriage, which is used when locating the wheel at a shoulder. Controls for operating the automatic traverse of the carriage and the power movement of the wheel are also conveniently located, and at one side is a panel on which the motor switches and controls are within reach. Starting and stopping of all four motors is accomplished by means of push-button switches which give the operator instant control of the entire machine.

The grinding wheel is driven by a 40-horsepower adjustable-speed motor, the range of speeds making possible efficient wheel speeds as the size of the wheel becomes reduced through wear. A wheel 24 inches in diameter with an 8-inch face is employed on the roll body, while a wheel of the same dimensions, but having a radius formed on one corner to produce the fillet, is used in the neck grinding operation. A radial truing device employing a diamond is used to dress the wheel to an accurate radius, and by locking the spindle of the attachment, it may also be used for truing the face of the wheel. For truing a wheel not requiring a radius, a plain table-type diamond tool-holder is provided.

A power movement of the wheel-slide is available to facilitate the movement of the wheel through a considerable distance. Before engaging the power mechanism, it is necessary to operate a safety lever which throws the handwheel out of mesh, thus preventing the operator from being injured. Flood lubrication is provided for the wheel-spindle by a pump mounted on the wheel-slide which draws from an oil reservoir having a capacity of eight gallons. Glasses on top of the bearings make the flow of oil into the boxes visible to the operator from his normal position.

Two beds support the distinct units of the machine, one the wheel carriage and the other the work. A channel between the beds drains the grinding compound into a settling tank, from which it flows to the pump pit. The entire system of tanks and channels has a capacity in excess of 1500 gallons of coolant. The compound is delivered at the wheel through a pump driven by a three-horsepower vertical motor.

The headstock is fixed on the work-bed and weighs approximately 10,850 pounds, the spindle alone weighing 1900 pounds. The spindle is 12 inches in diameter, and has a total bearing length in its two boxes of almost 52 inches. A 20-horsepower adjustable-speed motor drives the headstock spindle through a spur gear reduction train and a worm meshing with the spindle gear. A tool-steel center, 6 inches in diameter, is provided for use in setting up the work and in supporting the roll while grinding the journal bearings. The footstock is movable along the bed by means of a hand-ratchet having sufficient leverage to permit one man to operate it, but when desired, this unit can be provided with a two-horsepower motor for moving it. The footstock is also provided with a 6-inch center.

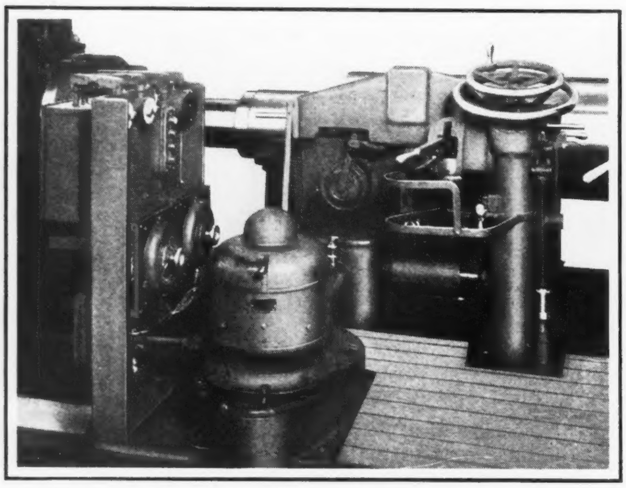


Fig. 2. View showing Accessibility of All Controls on Norton Grinder

A special set of heavy three-bearing journal rests supports the roll during the body-grinding operation. Adjustments are provided to align the roll relative to the wheel and to compensate for the reduction in the journal size due to grinding and for the wear of the brasses. When the requirements necessitate the forming of the roll face, an attachment is furnished that is applicable to the regular machine. This device is mounted on a base behind the wheel carriage, and consists of an adjustable-form bar which is presented to a hardened roller on the wheel-slide. As the carriage is traversed, the form of the bar is reproduced on the roll face. Roller bearings under the wheel-slide provide the free sensitive movement of the slide necessary in the reproduction of accurate contours. A hand-operated chain hoist is furnished for use in mounting the wheel. The column that supports the hoist swivels, so that the wheel with its sleeve can be lifted from the floor to the spindle without trouble.

LANDIS PIPE THREADING AND CUTTING MACHINE

The latest addition to the line of pipe threading and cutting machines built by the Landis Machine Co., Inc., Waynesboro, Pa., is an 8-inch size having a range for pipe from 2 1/2 to 8 inches, inclusive. Two die-heads are employed for covering this range, one head being intended for pipe from 2 1/2 to 4 inches, inclusive, and the other for pipe from 4 to 8 inches, inclusive. One important difference between this and the 4- and 6-inch pipe threading and cutting machines built by the same company, is that the front chuck is not lever-operated. The travel of the carriage is 24 3/4 inches, and there are eight speeds.

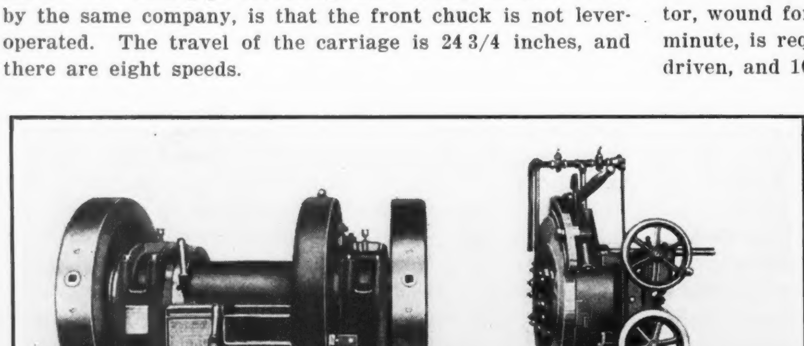


Fig. 1. Landis Pipe Threading and Cutting Machine

From Fig. 1 it will be seen that the machine is equipped with a gear-box and a single-pulley drive. The gear-box is located beneath the main spindle, and through it are obtained the variations in speed. All gears are cut from steel and run in an oil bath. The shaft bearings are lubricated automatically by a forced-feed system, and the main bearings are lubricated by flat-link chains running in oil reservoirs. The front and rear gripping chucks have a universal adjustment and are self-centering on the pipe. The rear chuck is provided with grips for screwing flanges on and off, and both chucks are provided with three jaws. A reverse drive in the gear-box is employed in putting on and taking off the flanges. The reverse is controlled by a lever located within convenient reach of the operator, which constitutes an important feature of the machine.

The cross-rail supports the die-head, and at the rear is fitted with centering jaws, cutting-off tools, a reaming tool, and a length gage. The die lubricating system includes a rotary pump, a by-pass for the surplus oil, and a special control valve at the head and at the cutting-off tools.

The machine is easily adapted to a motor drive, as shown in Fig. 2, and the motor can be readily applied after the

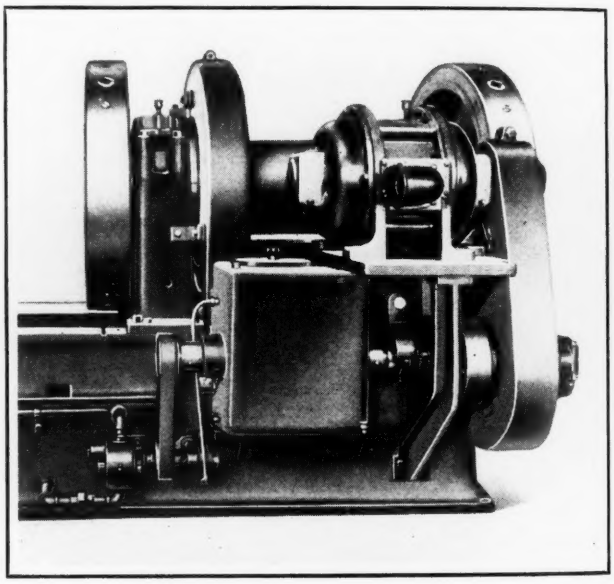


Fig. 2. Motor Drive on Rear of Machine

machine is in service. It is mounted on a plate over the gear-box, and a silent chain transmits the power from the motor to the machine. A 10-horsepower constant-speed motor, wound for an approximate speed of 1200 revolutions per minute, is required. The machine weighs 9750 pounds belt-driven, and 10,500 pounds motor-driven.

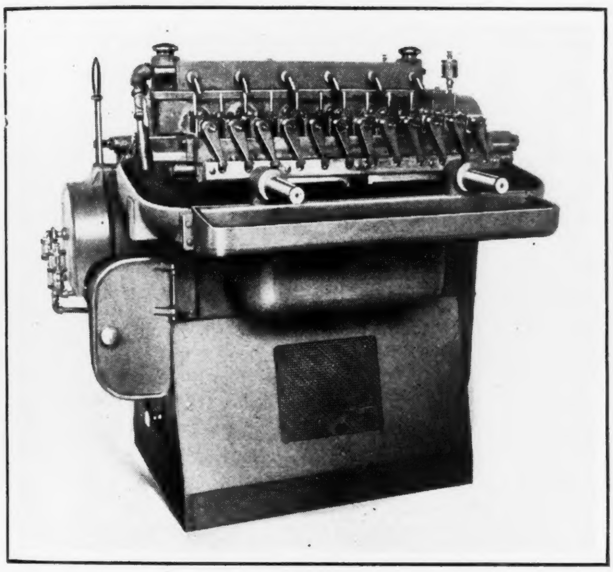
KENT SIX-SPINDLE DRILLING MACHINE

A semi-automatic horizontal multiple-spindle machine designed for drilling holes in bolts, pins, and other circular or hexagonal pieces, six at a time, is shown in the accompanying illustration. This machine is similar to one formerly manufactured by the National Acme Co., Cleveland, Ohio, from whom the manufacturing rights were purchased by the Kent Machine Co., Kent, Ohio, the builder of the improved design. There are twelve fixtures on the table, and these are so arranged that when six of them are directly in front of the drill spindles with work clamped in them, the other six fixtures are in position for being reloaded.

After the drilling operation has been accomplished on the parts held in the first

group of fixtures and the drills have been withdrawn from the work, the table automatically shifts to bring the second set of fixtures in front of the drill spindles. At the same time, the work is automatically locked in place in the second group of fixtures and unlocked in the first group. Unloading and reloading of the first group of fixtures is then performed by the operator while the second set of parts is being drilled, and when the second lot has been finished, the table is again shifted and the cycle of operations started once more.

The only time lost is that consumed in shifting the table. This action is rapid and requires only a small fraction of the revolution of a camshaft. The movement of the fixture table toward the drill spindles is rapid to a point where the drills are about to enter the work, and then slows down to the proper feed for the given speed and diameter of the drills. There is a quick return of the table through a mechanism that is easily adjusted by changing the location of two dogs on a revolving disk at one end of the machine. This adjustment can be made in a few seconds. The quick return can be so arranged as to give the operator just the necessary amount of time for reloading the work. A special quick unloading fixture can be provided for unloading all



Kent Semi-automatic Six-spindle Drilling Machine of Horizontal Design

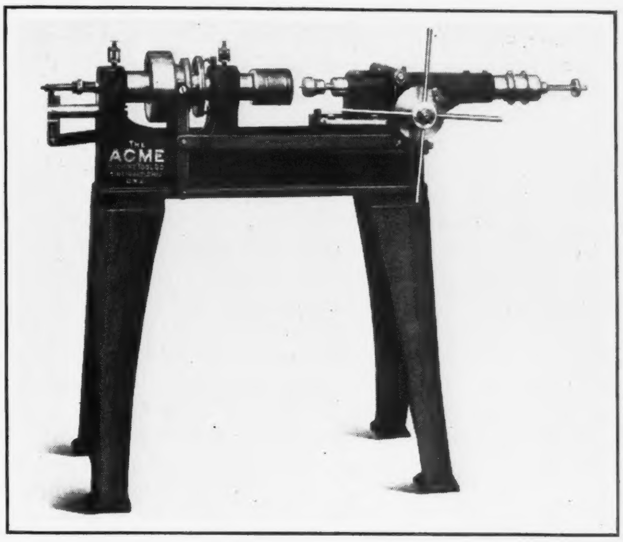
six fixtures simultaneously and thus save the operator's time. A set of change-gears permits variations in the feed to adapt the machine for drilling any kind of material.

The spindles are driven by a single horizontal shaft on which gears are mounted that engage gears on the drill spindles. For lubricating the bearings and gears in the spindle driving box, oil is forced to the top of this box by a centrifugal pump and cataracts down upon the gears. Individual oil delivery pipes run from this box to the several bearings. The lubrication of other working parts of the machine is accomplished through sight-feed oil-cups and ball oilers. A continuous supply of cutting lubricant is furnished to the drill spindles.

The machine is furnished with either a belt or a motor drive, and it has a capacity for drills from 3/64 to 1/4 inch in diameter. The standard fixtures accommodate either round or hexagonal stock from 3/16 to 3/4 inch, and special fixtures may be furnished to take similar stock up to 1 inch.

ACME PISTON CENTERING MACHINE

A semi-automatic machine which is built by the Acme Machine Tool Co., Cincinnati, Ohio, for centering the closed end of



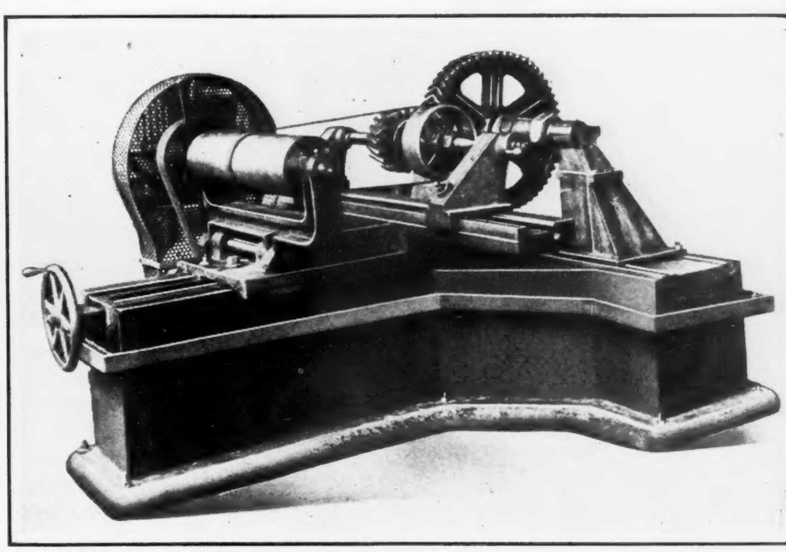
Acme Piston Centering Machine

automobile pistons, is shown in the accompanying illustration. It is intended that the skirt of the piston be bored and faced and the wrist-pin holes finished before the piston comes to this machine. The piston is held on the nose of the headstock spindle by a pin which is entered through the wrist-pin holes and drawn tight by a draw-bar extending through the spindle. There is a drill head mounted on the right-hand end of the bed, and this head contains a spindle which is driven at a high speed in the direction opposite to the rotation of the work. This drill spindle is driven by a belt separate from that of the work-spindle.

After a piston has been slipped on the work-spindle and a pin placed through the wrist-pin hole, the turnstile handle of the drill head is revolved to operate the draw-bar and clamp the piston in place. Further turning releases a brake from the work-spindle and engages a clutch to transmit the drive to the work-spindle. A still further movement of the turnstile in the same direction causes the drill to advance and center the piston. Reversal of the turnstile withdraws the drill, disengages the clutch, applies a brake to the work-spindle, and pulls forward the draw-bar to release the work.

SYKES GEAR LAPPING AND TESTING MACHINE

A machine intended for testing and lapping gears produced in the Sykes gear generators built by the Farrel Foundry & Machine Co., Buffalo, N. Y., has been brought out by the same company. The gear to be tested is mounted on an arbor, and the arbor is arranged to rotate in a pair of



Sykes Gear Lapping and Testing Machine

pedestal bearings, as illustrated. One of the pedestals is adjustable along T-slots cut in the bed, so as to accommodate various widths of gears, while the other pedestal is bolted stationary on the bed.

Two other pedestals for supporting the pinion to be tested are mounted on a carriage which can be moved at right angles to the gear arbor, by means of a handwheel and lead-screw. Both of the pinion pedestals are adjustable on the carriage in a direction parallel to the axis of the gear arbor, and the pedestals can be arranged to support an arbor or a shaft on which the pinion is integral. The machine is equipped with a scale having a vernier attachment for accurately measuring the distance between the centers of the gears. A split steel pulley secured to the pinion arbor serves to rotate the pair of gears, the pulley being driven through a belt by a drum pivoted on the rear end of the carriage. A motor on the floor drives this drum.

The gears to be tested are thoroughly cleaned, placed in the machine as described, and then rotated in mesh. During this rotation, any defects that cause noise are at once discernible, as well as other characteristics of the teeth. Lapping compound may then be introduced between the teeth, if necessary, and the action watched until the desired results are obtained. The machine illustrated handles gears up to 48 inches in diameter and of any width, and is carried in stock. Other machines can be built for a larger or smaller range of work.

"HOMO" ELECTRIC DRAWING MACHINE

An electric furnace known as the "Homo," which heats by forced convection rather than by radiation, and which uses air as the heating medium instead of oil or salt, is a recent development of the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. This furnace is intended for use in tempering steel parts in production quantities. The principal advantages claimed for the method are uniformity, both as to time and temperature, throughout the entire load regardless of its density; an accurate chart record of each batch of work; and the accurate matching of batches of parts to any previous batch selected as a standard.

The operation of the furnace is automatic, and the time for bringing a load uniformly to temperature is minimized so as to increase the furnace output and thus reduce the number of units, investment, floor space, and fuel. The equipment is thoroughly insulated, so that it can be placed directly in the line of production. There is nothing to handle except the actual work. The furnace has an easily removable lid and holds the work in a removable basket, as illustrated in Fig. 2. This basket is open at the top and the bottom is a heavy grid. Below the basket is a fan driven by an external motor which reverses automatically. Between the inner cylindrical wall of the furnace, which closely surrounds the basket, and the heavily insulated outer wall is an air space. In this space, heating coils of nickel-chromium wire are supported between insulating clamps. The fan, reversing at short intervals, drives the air up through the coils and down evenly through the load, then down through the coils and up through the load. This insures a uniform temperature.

Fig. 1. Leeds & Northrup Electric Tempering Furnace

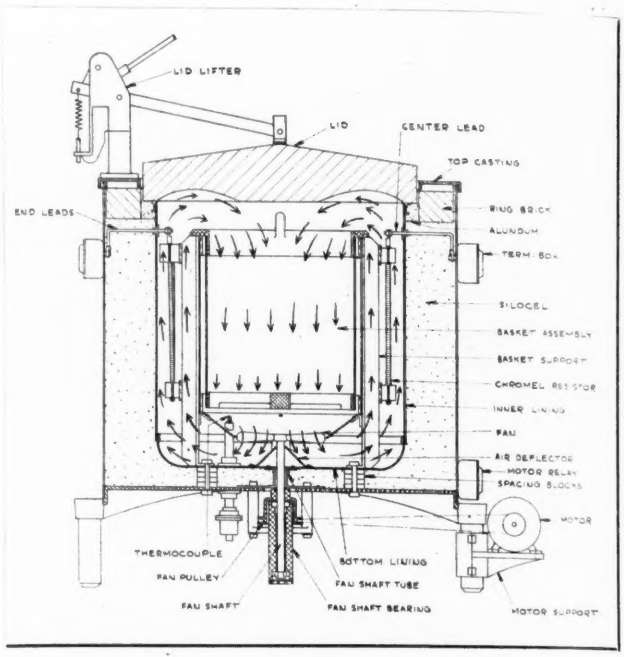


Fig. 2. Sectional View of the Furnace which heats by Convection and uses Air as the Heating Medium

The furnace is controlled automatically by a recorder controller. The operator simply sets a device to the desired temperature, after which the controller automatically varies the current input from the high load needed to obtain this temperature to the light load required to hold it at the maximum for the necessary period of time. The time needed for the work to reach a given temperature is said to be short, thus allowing plenty of time for the heat to penetrate to the interior of each piece and yet permit drawing in a short space of time. The controller also operates an automatic switch to reverse the rotation of the fan. Each drawing operation is recorded by the controller, so that for every batch of work there is a corresponding record that can be compared with a master or used as a master. The complete equipment consists of the furnace, the two baskets, a single-point recording potentiometer controller, and an automatic control panel. Patents are pending on this method of tempering steel.

MORTON ROLL WABBLE PLANER

A machine recently built by the Morton Mfg. Co., McKinney Ave., and Hoyt St., Muskegon Heights, Mich., for planing the wabble ends of steel mill rolls of any type is shown in the accompanying illustration. This machine is necessarily of the push-cut type, and is equipped with a special traveling head. The base is made in two sections for convenience in shipping, and is of sufficient length to accommodate the longest rolls. It is provided with flat-rail bearings on which the outer support for the roll may be ad-

justed to any desired position, and the center rib has rack teeth to take care of end thrust. The bed is so trunnioned to the base that it may be swung in either direction sufficiently to obtain tapers of as much as 1 1/2 inches per foot. The traveling head is closely fitted to square rails on top of the bed. A plate with vertical square rails is bolted to the front of the bed, and the angular knee or table is fitted to these rails.

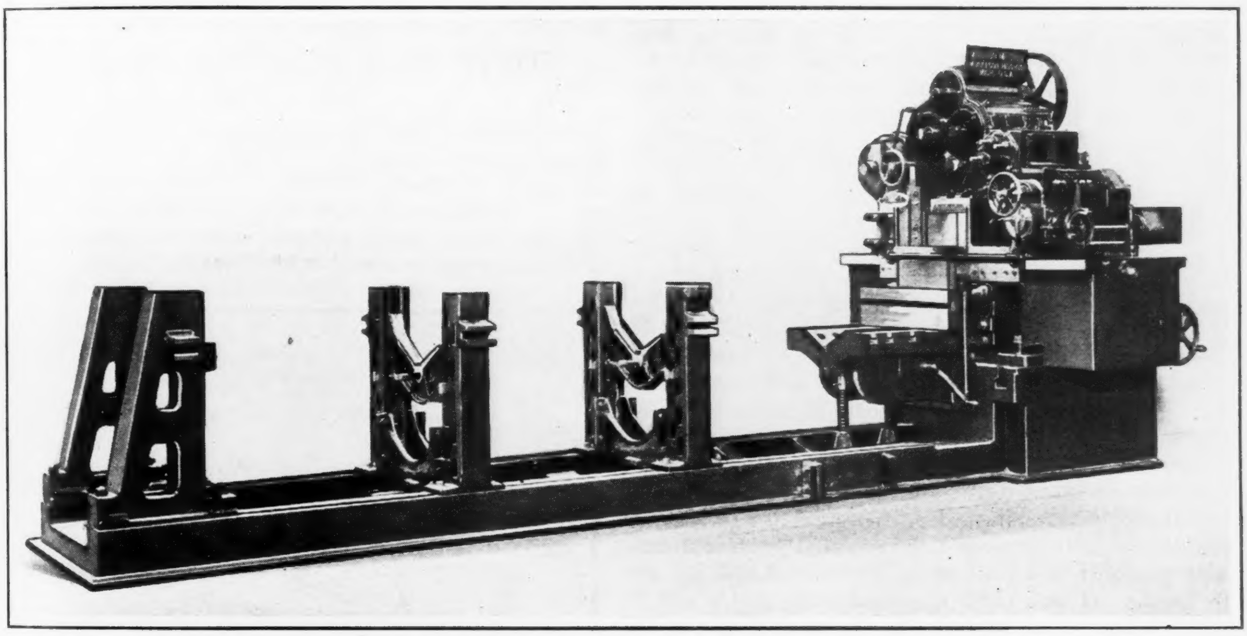
The table is provided with a machined vee for supporting the neck of the roll, and with T-slots on the upper surface for bolting purposes. There is also a horizontal T-slot on the vertical portion, so that parallel bolts may be used for holding the rolls against the cutting strains. The knee is adjustable vertically to accommodate rolls of various sizes, by revolving a screw through the use of a crank. Both sides of the supporting frame for the outer V-block are provided with square slots which permit adjustment of the block into the proper position.

All the feeding and operating mechanism of the traveling head is self-contained. The driving gears are enclosed in the column and run in oil. The ram is a square hollow-bored high-carbon steel forging, and the rack is cut from the solid. Inserted centrally with the rack face is a bronze strip that forms a continuous bearing. Wear is taken up by means of adjustable taper gibs on the side and top of the ram. One end of the ram is threaded to receive the cutter-head. The reciprocating motion of the ram is obtained by means of friction clutches and compound disks placed in a chamber inside the column and running in oil. The clutch for stopping and starting the machine independently of the motor is also self-oiling.

The reversing mechanism for operating the clutches on the reciprocating stroke is of a new design with a sliding bar and revolving cam. Adjustment of the stroke is obtained by means of tappets on a disk, and the adjustments can be made while the machine is in motion. Reversal of the machine is accomplished at the will of the operator by manipulating a lever. The machine will take a cut and reverse close to a line. The feed is made at the end of the return stroke and consequently the tool does not drag on the work.

The clutches are of a new design in which the friction surfaces are flat with the revolving disk, and the compression is produced by sliding collars and levers. A splash system of oiling is used for the clutches and for all shaft journals subject to heavy cutting strains. The oil is placed in a suitable chamber and supplied to the ram by a rotary pump which operates only when the machine is running. From the ram, the oil is distributed into sight-feed lubricators, while the overflow lubricates other journals. The motor equipment is attached to a bracket on the rear of the head and includes a variable-speed controller.

Some of the principal specifications of this machine are as follows: Stroke of ram, 32 inches; greatest longitudinal feed of column, 16 inches; feed of head, 10 inches; greatest distance from inner V-block to outer V-block, 14 feet; vertical travel of inner V-block, 14 inches; greatest diameter between tool and V-block, 28 inches; distance from top of ways to bottom of ram, 50 inches; maximum diameter of roll, 56 inches; and maximum diameter of neck, 28 inches. Larger machines can be built if desired.



Morton Traveling-head Planer built for machining the Wabble Ends of Large Steel Mill Rolls

SYKES GEAR-TOOTH COMPARATOR

The Sykes gear-tooth comparator, which has been marketed in England for the last year or two, is now also manufactured by the Farrel Foundry & Machine Co., Buffalo, N. Y. One of the advantages claimed for this comparator is the absence of wear that would impair its accuracy. As illustrated at *A*, in Fig. 1, the setting of the jaws is obtained through the use of gage-blocks that are in the form of rack teeth. These gage-blocks do not wear appreciably even with constant use, because the contacting surfaces are large and hard; moreover the blocks are used infrequently. The jaws of the instrument have a tangential bearing on the gear tooth being measured, and the point of contact between the jaws and the tooth varies on different gears so that any wear is distributed. Wear on the jaws, however, does not affect the precision of the instrument, since the jaws are always set to a master gage-block. The view at *B* in Fig. 1 shows the method of applying the comparator to the tooth of a gear.

In Fig. 2, lines *a* represent the outline of the rack teeth, and the dotted lines, the jaws of the comparator. It will be seen that the dotted lines follow the rack teeth outline. Line *c* is the pitch line of the rack teeth, and *d* the pitch circle of the pinion or gear. Lines *b*–*b* are the lines of pressure, or lines of action, on which involute tooth contact always occurs, regardless of the size or number of teeth in the gear. These lines are always the same for any given pressure angle *x*.

It is well known that in the involute gear system the rack tooth has straight sides and that the first law of gear

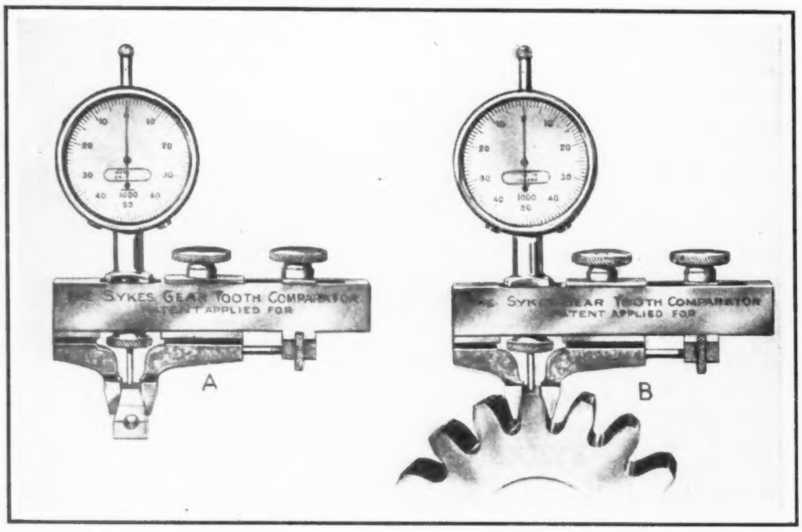


Fig. 1. Illustrations showing how the Sykes Gear Tooth Comparator is set and applied

tooth contact is "The common normal to the tooth curves must pass through the pitch point." In the diagram, lines *b–b* pass through the pitch point *p* and are normal to the rack tooth profile. Contact must always take place on lines *b–b*, and the position of the point of contact *e* depends only on the thickness of the tooth. In gears of any particular pitch, the profile of the teeth is different for each given number of teeth, but the point *e* of contact will always be the same provided the tooth thickness is the same. It will vary in direct proportion to the tooth thickness. The principle of the comparator is analogous to the principles used in gear-cutting machines of the generating type.

In setting the comparator for inspecting a gear, it is preferable to use a gage-block of the same proportions as a rack for the gear would be. However, it is not necessary to have a gage-block of the exact size, in which case the setting of the jaws may be determined either from a table of differences or by means of a simple calculation. For instance, it is possible to use a 2 diametral pitch tooth block for measuring 2 1/2 diametral pitch teeth. A set of seven blocks enables teeth of every diametral pitch between 9 and 1 to be measured, and a set of six blocks is suitable for all teeth between 12 and 1 1/2 diametral pitch or 1/4 and 2 inches circular pitch.

It will be obvious that the exact thickness of the teeth can immediately be determined if the thickness of the gage-block is known. The gage-blocks are made one-half of the circular pitch along the pitch line. The actual amount of discrepancy in the teeth of a gear can be noted either in terms of the dial reading or in terms of tooth thickness. If the pressure angle is 14 1/2 degrees, 0.001 inch on the dial represents 0.000517 inch on the thickness of the tooth,

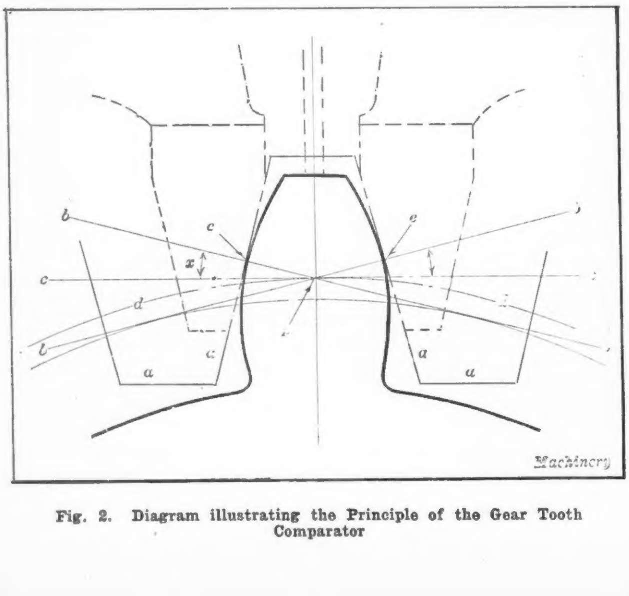


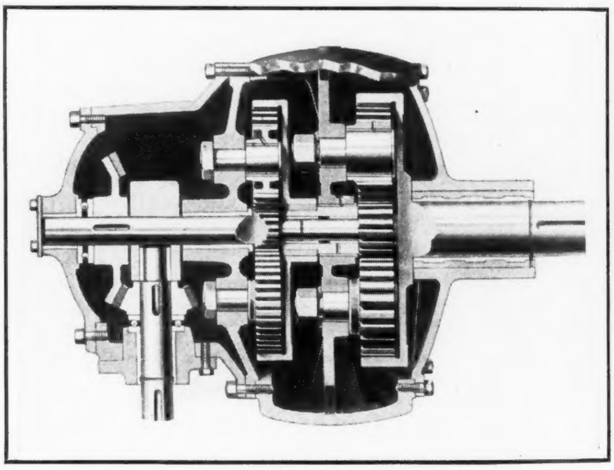
Fig. 2. Diagram illustrating the Principle of the Gear Tooth Comparator

or for all practical purposes, 0.0005 inch. Conversely, 0.001 inch on the tooth thickness equals 0.001930 inch on the dial indicator. The comparator is said to measure tooth thicknesses within 0.0002 inch.

The instrument is furnished in a box complete with a set of gage-blocks for teeth from 12 to 1 1/2 diametral pitch, inclusive. The instrument and gage-blocks are made standard for a 14 1/2-degree pressure angle, but they can be supplied for any other pressure angle. The gage-blocks are made of crucible cast steel, hardened and lapped, and the jaws of the instrument are also hardened and lapped. This comparator may also be used for quickly obtaining the exact depth to which a gear-cutting tool should be set. One of the principal features claimed for the comparator is that the accuracy obtained by its use does not depend upon skill on the part of the operator.

FOOTE BROS. RIGHT-ANGLE SPEED REDUCERS

Right-angle drive spur-gear speed reducers are being placed on the market by Foote Bros. Gear & Machine Co., 232-242 N. Curtis St., Chicago, Ill., for application where space is limited, as in cases where it is necessary to change the direction of power delivery, where the driven machine is located close to a wall, and where the reducer is to be mounted within or on top of a machine. This "IXL" unit is similar in appearance to the standard straight-line drive spur-gear speed reducers built by this company, but the high-speed shaft projects at right angles to the axis of the low-speed shaft. The change in the direction of the power delivery is accomplished by means of bevel or miter gears mounted in the high-speed end of the unit, as shown in the illustration.



Internal Construction of Foote Bros. Right-angle Drive Spur-gear Speed Reducers

The high-speed pinion is integral with the high-speed shaft and delivers power through three idler gears set at an angle of 120 degrees relative to a large rotating internal gear. The internal gear is fastened to the slow-speed shaft. Thus the high-speed pinion, together with the idlers, internal gear, and slow-speed shaft, comprise the mechanism for a single reduction train that can be repeated to secure greater reduction ratios. By changing the sizes of the pinion and the internal gear, and the relative sizes of the bevel gears, almost any desired relation can be obtained between the high-speed and low-speed shafts. The new reducers are built in a large range of standard sizes up to 150 horsepower, with reduction ratios up to 350 to 1.

GARDNER VERTICAL-MOTOR DISK GRINDER

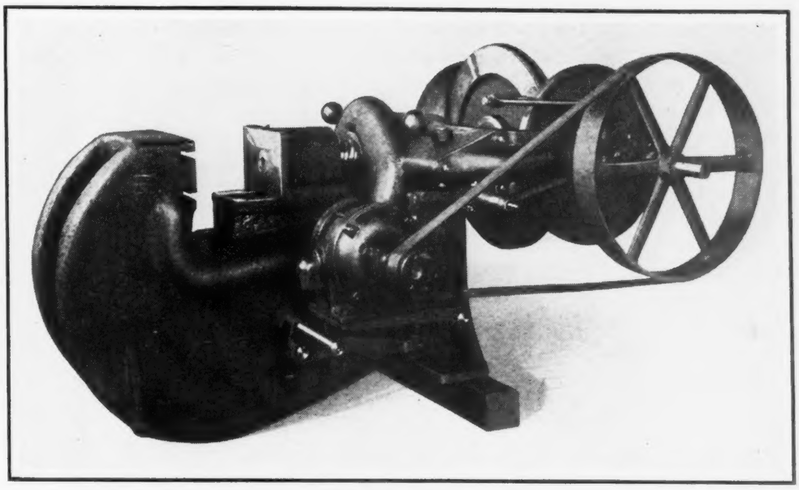
Either wet or dry grinding may be performed on a No. 24 vertical-spindle disk grinder equipped with a 53-inch wheel, which has recently been brought out by the Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. The direct-connected vertical-motor drive makes the machine a compact self-contained unit, occupying a minimum amount of floor space. The motor frame itself serves as a pedestal for the machine, the machine base being the motor end plate. The motor frame is especially constructed so that air circulates through it without circulating through and around the rotor and stator windings. Cool air is drawn up through openings in the base by fan blades, mounted on the under side of the disk wheel, and after circulating around the motor frame, is forced out through eight holes spaced around the machine. A remote-control push-button switch is mounted at any convenient point on the base.

A cast-iron guard ring is fastened to the top of the base, and to it may be secured work-holders, a dressing device, etc. A rigid horizontal-bar dressing device is provided, in which a sliding block carrying the dresser cutters is forced back and forth across the abrasive disk by hand. A special patented pneumatic press, similar to that mentioned in the description of the Gardner vertical-spindle disk grinder in November MACHINERY, is furnished for setting up the abrasive disk. The spindle is made of crucible steel and is mounted in radial and thrust ball bearings.

Gardner Vertical-spindle Disk Grinder driven by Vertical Motor

In order to enable either wet or dry grinding to be performed, the upper or body portion of the machine serves as a reservoir for water or other coolant, being in no way an integral part of the motor-head casting. It is shaped to allow ample knee and foot room for the operator. The reservoir has a capacity of 55 gallons, and is supplied with eight hand-holes in the bottom to permit cleaning out the sludge. Each hand-hole cover is drilled and tapped, so that a water drain can be applied to suit the location of the machine. A substantial overflow is arranged for at the top of the reservoir, so that water or grinding compound cannot get into the spindle bearings.

A motor-driven pumping unit can be attached to one of the hand-hole covers, and as these covers are interchangeable, the pumping unit may be placed at any point around the machine to suit floor conditions. When the machine is used for dry grinding, the coolant reservoir is used in connection with the exhaust system. The machine weighs approximately 4400 pounds, and occupies an operating floor space of 10 by 10 feet.



Zeh & Hahnemann Percussion Power Press of Horizontal Design

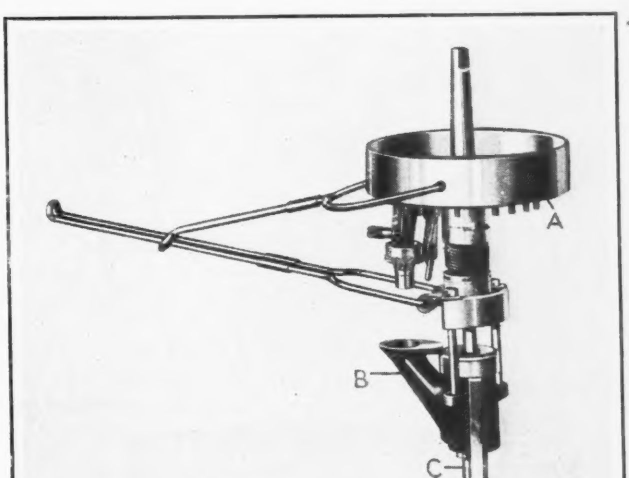
ZEH & HAHNEMANN HORIZONTAL PERCUSSION PRESS

A new type of percussion power press has been brought out by the Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J., to meet the requirements of plants manufacturing industrial railways. This press—the No. 16-10—is constructed to yield normally a pressure of 100 tons. It is arranged horizontally so as to permit work suspended from a runway to be passed freely through the press for riveting operations. Several rivets are headed cold at each stroke of the press.

Either a direct-connected motor drive or a belt drive can be furnished. The operation of the machine is controlled by means of a foot-treadle similar to ordinary presses. The machine stops positively at the end of the reverse stroke, and is held there by a brake with the friction disks in a neutral position. As the work or die terminates the working stroke, an emergency device stops the press positively and safely. The frame is a steel casting, and is made with a large gap or throat. The press has a stroke of 10 inches and weighs about 10,500 pounds.

AUTOMATIC SCREWDRIVING MACHINE

An automatic screwdriving attachment intended for application to drilling machines is the latest product of the Metal Saw & Machine Co., Inc., 40 Napier St., Springfield, Mass. It is built in twelve sizes for driving machine and wood screws from 1/4 to 3 inches long. A quantity of screws of the required size is poured into hopper *A*. This hopper has an eccentric motion, which causes the screws to fall into



Automatic Screwdriving Attachment manufactured by the Metal Saw & Machine Co., Inc.

a slot that is large enough to enclose the neck of the screws loosely, but not so large as to allow the head to pass through.

To start the feed, the delivery member *B* is lifted as far as it will go and then allowed to return to its normal position. This action causes the first screw to appear at nozzle *C*, and it is then driven into the work by operating the regular sensitive feed-lever of the drilling machine. The action of driving this screw automatically feeds another screw into place ready for use.

One of the advantages of the attachment is that the screw is plainly visible to the operator when in the nozzle, and consequently can be easily located on the work. Another feature is that the delivery member *B* may be stopped at any predetermined point so as to prevent damage to delicate work. Screws can be driven, regardless of variations in the work, without separate adjustment of either the delivery member or the machine table. Simple fixtures for holding the work beneath the nozzle can be designed to facilitate operations.

HAMMOND NUT AND STUD DRIVING MACHINES

Nut setting and stud driving machines of column and wall types are now built by the Hammond Mfg. Co., 7808 Kinsman Road, Cleveland, Ohio, with the hinged-arm feature of the Hammond radial drilling and tapping machine. The arm design permits the operator to move the spindle from one position to another with a single straight-line motion. The arm swings on radial ball bearings, which reduces to a minimum the effort required on the part of the operator. These machines are designed primarily for driving studs, nuts, cap-screws, etc., used in the assembly of automobile engines, chassis, and other units. They will drive studs and set nuts to any desired degree of tightness.

The column type machine may be equipped either with a T-slotted base, as shown in Fig. 1, or with a pedestal base. The wall or post type illustrated in Fig. 2 has the arm assembly mounted on a slide or shoe, and is provided with the same vertical adjustment as the column type. The machines are driven by a ball-bearing alternating-current motor, mounted in a vertical position on the outer arm and belted direct to the spindle driving pulley. A ball-bearing idler is provided in this drive for maintaining the proper belt tension. There is a gear reduction of approximately 2 1/2 to 1 between the driving pulley and the spindle to supply ample power and suitable speed for handling studs up to 5/8 inch in diameter or nuts up to 5/8 inch.

In setting nuts, the operator inserts the nut in a special socket wrench in the spindle, starts the spindle by pressing down on the operating lever, and then brings the nut down

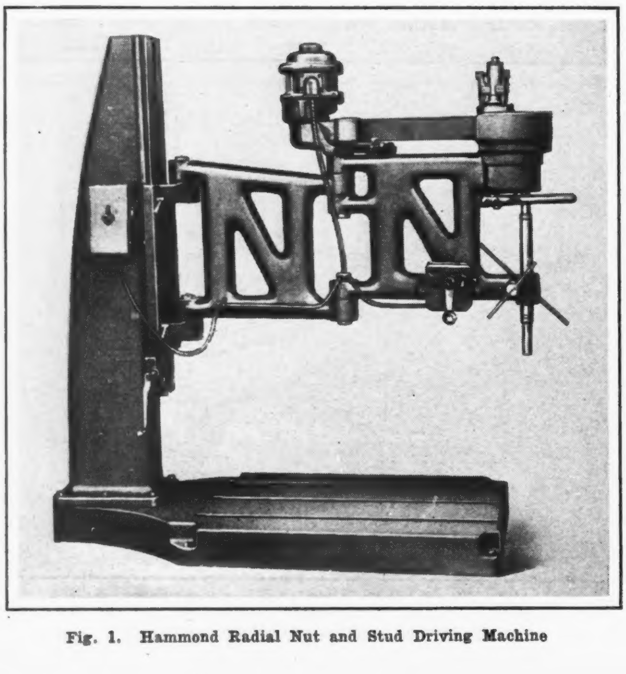


Fig. 1. Hammond Radial Nut and Stud Driving Machine

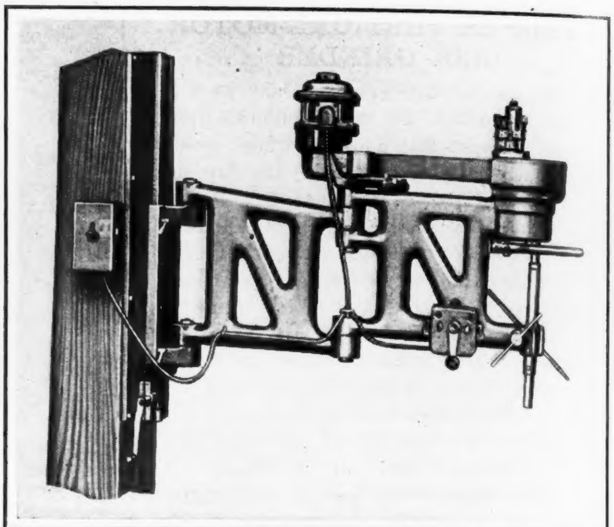


Fig. 2. Wall-type Machine equipped with Reversing Switch

on the stud. The moment the nut is tight, the spindle stops automatically due to the opening of a driving clutch in the spindle pulley. The operator then raises the spindle, inserts another nut, and repeats the operation. The average time consumed in setting a nut is about five seconds. The same method is followed in driving cap-screws, spark plugs, etc., and by reversing the motor, nuts or cap-screws previously tightened may be removed.

For driving studs to a uniform height, a geared head without the releasing clutch is recommended by the builder of the machines. Then a standard stud-driving chuck having split half-nuts that release when the stud has been driven to a predetermined depth is used. A solid threaded chuck is used in connection with the releasing driving clutch, and when the stud is driven tight, the clutch automatically disengages and the spindle stops. The motor is then reversed and the chuck backed off from the stud. Some of the principal specifications of this machine are as follows: Maximum distance from spindle to face of column, 52 inches; minimum distance from spindle to column, 18 inches; vertical adjustment of saddle on column, 24 inches; and traverse of spindle, 8 inches.

POOLE FLEXIBLE COUPLING

A flexible coupling having only six parts is now being introduced on the market by the Poole Engineering & Machine Co., Baltimore, Md. This coupling is designed to compensate for the usual errors of shaft misalignment in all classes of connected machinery, and to allow free end float to two connected shafts. As may be seen in the illustrations, two of the parts are hubs, each of which has an external gear. These gears mesh with internal gears in two sleeves that are bolted together, and two aligning rings are fitted in the sleeves. The outer faces of the teeth on the hubs are made spherical to provide a self-aligning bearing for the connecting sleeve. Thus, if two connecting shafts are out of alignment, the sleeve assumes a neutral position with a formed and lubricated bearing on the spherical surface of each of the shaft hubs.

The coupling is easy to line up when being assembled on connecting shafts. Each hub has a tapered surface which, in turn, engages a tapered surface on the interior of the corresponding sleeve. When the sleeve is pushed back, the sleeve, hub, and shaft act as a single unit, and proper alignment can be quickly and accurately made by using a straightedge across the two flanges of the sleeves and calipers or feeler gages between the coupling faces. The sleeves and hubs are never out of tooth engagement during alignment. All parts are made of high-carbon forged steel and are interchangeable.

Oil-holes are provided in one side of the coupling flange where oil should be poured until it runs around the shaft hub. When the coupling is running, the oil spreads

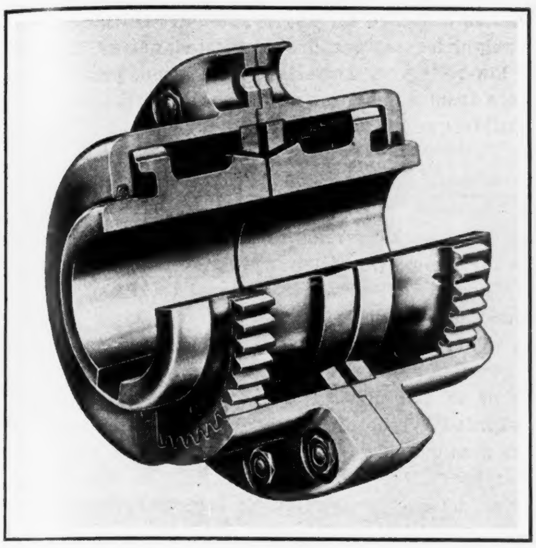


Fig. 1. Sectional Illustration of the Poole Flexible Coupling

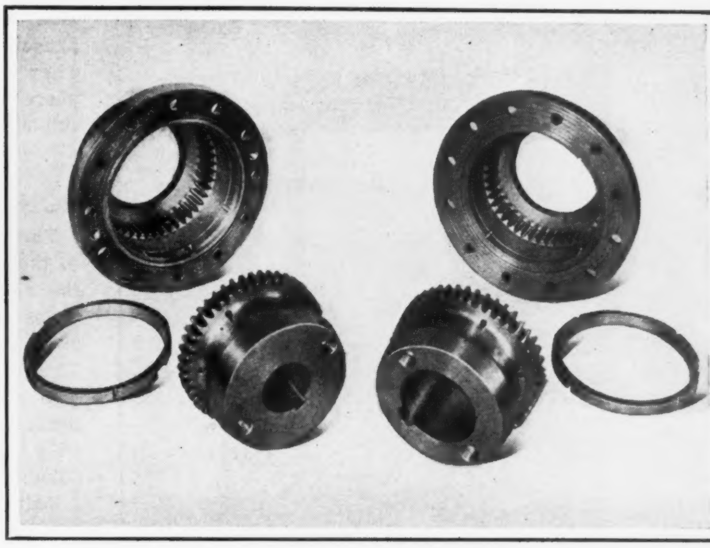


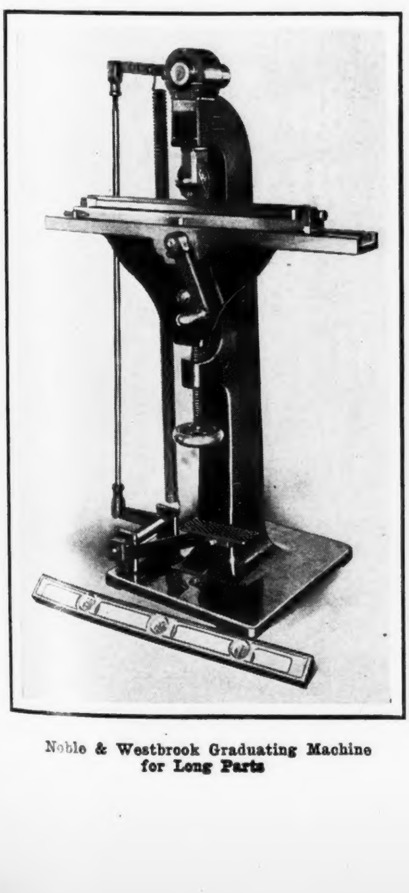
Fig. 2. Disassembled Parts of Flexible Coupling

outward under centrifugal pressure so that the sleeve bearings and the gear teeth are entirely submerged. This effectually reduces wear of any contacting surfaces and assures positive lubrication of the surfaces as long as there is oil in the coupling.

In addition to the simplicity of the design, a feature claimed for this all-metal gear-type coupling is self-alignment without a binding action at any point. It is also claimed that the strength of the coupling is always greater than that of the connecting shafts. There is a complete protection from dust and dirt, and the coupling functions equally well in either direction, on continuous or reversing service, and at high or low speeds. Couplings of any capacity can be furnished to meet requirements.

NOBLE & WESTBROOK LEVEL GRADUATING MACHINE

A machine for marking graduations and figures along the edge of a level or other long part has been brought out by the Noble & Westbrook Mfg. Co., 19 Asylum St., Hartford, Conn. The machine as built will graduate the face and mark the numbers in the same operation on a two-foot aluminum level. Movement of the table is accomplished through a rack and pinion operated by means of a hand-lever. With the table movement, the level passes under a circular die 12 inches in circumference, the die traveling twice over the work. The travel of the die is made accurate by a special rack and gear. Pressure of the die on the work is obtained by means of a spring and a cam in the head of the machine.



Noble & Westbrook Graduating Machine for Long Parts

The operation of the machine consists of depressing the foot-treadle when the table is at one end and then placing the part to be marked on the table, where it is held by proper gages. When the foot-treadle is released, pressure of the die is applied on the work, and then by turning the hand-crank, the table and the part to be marked are passed under the die. This machine is based upon the same principles as a number of other graduating machines developed by this company. It may be used to graduate long parts, even though there is a slight variation in their thickness.

JOHN UNIVERSAL TAPPING CHUCK

An improved design of the John universal tapping chuck manufactured by the Barber-Colman Co., Rockford, Ill., has recently been brought out. The new design includes a friction drive member that is intended to reduce tap breakage to a minimum. A universal type of chuck holds the tap, driving it equally on each side of the shank. This chuck is equipped with a five-point positive sensitive clutch which is capable of disengaging within 0.001 inch when the tap reaches a predetermined depth. Also, the chuck has a balanced drive concentric with the spindle, and will reverse at a 2 to 1 speed ratio. All gears run in oil.

John Universal Tapping Chuck with Friction Drive

The friction member is made of a special composition, and can be adjusted to slip freely should the tap touch the bottom of the hole. It is claimed that this feature prevents practically all tap breakage due to "bottoming." The improved chuck is adaptable to any drilling machine, and does away with all drive and retainer blocks furnished regularly with the previous chuck. It is made in two sizes, the No. 1 having a capacity for taps up to 3/8 inch, and the No. 2, for taps up to 5/8 inch. All wearing parts of the chuck are made of hardened alloy steel.

Ames Bench Lathe mounted on Cabinet and equipped with a Motor and Three-speed Gear Drive

AMES CABINET-TYPE BENCH LATHE

The No. 3 precision bench lathe built by the B. C. Ames Co., Waltham, Mass., can now be obtained mounted on a cabinet, as here illustrated. This cabinet equipment is supplied with a three-speed gear drive and an electric motor, and is intended for use either in regular production, experimental laboratories, or in home work-shops. The three-speed gear drive eliminates the countershaft and jack-shaft usually required to drive this type of lathe from an individual motor. It is a simple and positive adaptation of gears and friction clutches designed for operation by means of foot-treadles.

Either a 1/4- or 1/3-horsepower motor is furnished, and it is located in the compartment under the lathe having hinged doors. Only one belt extends through the top of the cabinet from the motor to the gear drive. Two forward speeds of 720 and 160 revolutions per minute, respectively, are available, and one reverse speed of 150 revolutions per minute. Current for driving the motor may be taken from any convenient lamp socket. A countershaft for driving grinding attachments may be furnished when desired.

The cabinet is constructed of finished oak, and made with four large drawers in which the lathe attachments may be kept. The cabinet measures 48 inches long, 25 inches wide, and 36 inches high, while the full height of the machine, including the uprights and the gear drive, is 76 inches. The top surface of the cabinet is covered with heavy linoleum, and a switch for the motor is located at the left-hand corner of the front side. The lathe itself is designed for precision turning, milling, grinding, drilling, and thread-cutting operations. Work up to 8 3/8 inches in diameter can be swung over the bed, and the bed is 36 inches long.

MONITOR "THERMALOAD" STARTER

In the new "Thermaload" starter manufactured by the Monitor Controller Co., Baltimore, Md., the thermal expansion units are made of metal. Thermal or heating units of various ratings are interchangeable, enabling the starter to be changed from one horsepower rating to another by inserting the proper thermal units. This permits motors to be changed or shifted about without changing or shifting starters and without disturbing the wiring. The "Thermaload" starter is designed for any type of drive where single-phase or polyphase motors are connected across the line. They give low-voltage and overload protection, protect polyphase motors from damage due to phase failure, and permit full-load, full-torque starting.

BONNEY CHROME-VANADIUM WRENCHES

Three styles of socket wrenches have recently been added to the line of chrome-vanadium wrenches manufactured by the Bonney Forge & Tool Works, Allentown, Pa. The new styles include the offset type, the T-handle type, and the brace type. There is a wide variation of sizes in each style. These socket wrenches are made of one-piece forgings.

In addition to the general advantages of strength and lightness afforded by the use of chrome-vanadium steel, this alloy makes possible thin socket walls, which is a particular advantage in cases where a nut or bolt is in a close corner. A ball-bearing handle constitutes an interesting feature of the brace-type wrenches.

MOLINE CYLINDER BORING AND LAPPING MACHINES

A No. 10-D automatic geared-feed cylinder boring machine and a No. 8 multiple-spindle lapping machine, which have recently been developed by the Moline Tool Co., Moline, Ill., are shown in Figs. 1 and 2, respectively. The cylinder boring machine has adjustable heads mounted on a rail which is traversed on two upright columns through gearing and screws. Ample travel is provided for the rail to raise the boring-bars sufficiently to clear the cylinder being bored. The boring operation is automatically accomplished; the operator shifts the feed-lever to engage the lever traverse downward, and when the tools approach the work, the rail is automatically slowed down to the boring feed. After the completion of the boring, the quick return is automatically engaged to bring the rail back to the starting position, where it stops. All trip-collars are adjustable, and change-gears give a range of feeds to suit the work.

This cylinder boring machine is also built with an Oilgear hydraulic automatic feed. Both types are designed for

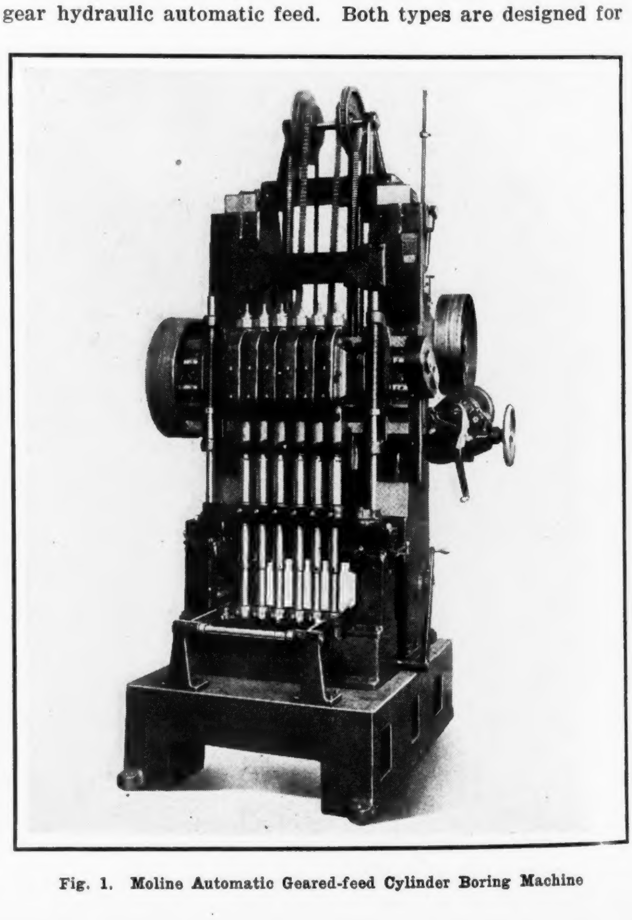


Fig. 1. Moline Automatic Geared-feed Cylinder Boring Machine

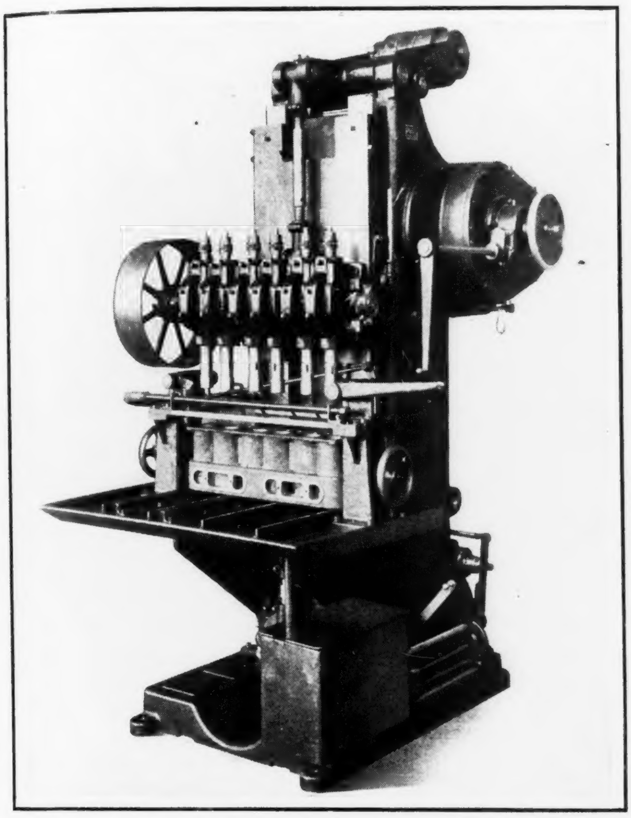


Fig. 2. Multiple-spindle Cylinder Lapping Machine equipped with Jig

precision line-boring, and so the boring-bars are piloted above and below the work in guide bushings.

The new multiple-spindle lapping machine, illustrated in Fig. 2, is substantially a universal machine, as the heads are adjustable to different center distances. These heads are mounted on a rail that is reciprocated up and down by means of an adjustable eccentric crank. The table is lifted by power to bring the cylinder into the working position. The machine is controlled by two clutches, one for the rotation of the spindles; the other for the reciprocation of the rail.

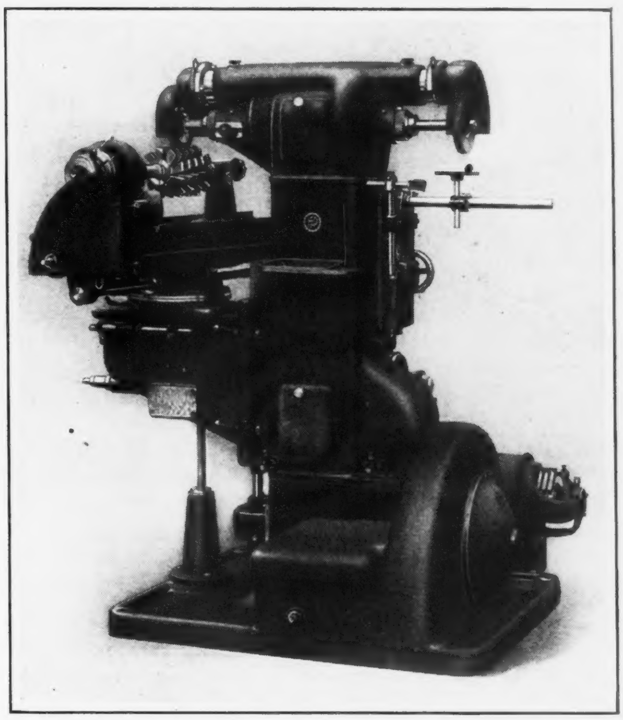
MILBURN OIL BURNER AND PREHEATER

An oil burner and preheater has recently been brought out by the Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md., for a variety of applications. For instance, it may be used for preheating castings to be welded, for heating soldering irons, and as a burner for core ovens and annealing furnaces. The device is of the atomizing type and utilizes the cheapest grade of crude, fuel, or kerosene oil or distillate. Compressed air at a pressure varying from 50 to 100 pounds per square inch is employed. The air supply line serves two purposes, furnishing a direct flow to the burner and also maintaining a pressure in the oil storage tank to create a greater velocity in the oil feed line and thus insure a positive and uniform flow of both oil and air. The air and oil flow through straight-line orifices. Oil under pressure enters the atomizing chamber at right angles to it and in an annular form, while the compressed air flows directly through the center, striking the filament of oil, atomizing it, and then expanding it into a venturi-shaped outlet.

Milburn Oil Burner and Preheater

PFAUTER AUTOMATIC HOB SHARPENING MACHINE

A Pfauter automatic hob grinding machine has recently been placed on the market by the O. Zernickow Co., 15 Park Row, New York City, for sharpening straight- or spiral-fluted hobs. Reamers, taps, and other cutters can also be ground, and by the use of a special fixture, face mills up to 13 3/4 inches in diameter can be handled.



Pfauter Hob Sharpening Machine with Vacuum Dust Remover

The grinding operation takes place during both the advance and return of the table. At the same time, the work is rotated according to the spiral of the flutes, through a change-gear arrangement located at the index-head. Change-gears are furnished for different spirals, together with tables that give the proper combinations of gears. The setting of the work relative to the grinding wheel and the indexing of the work from one flute to another are accomplished by hand, but the table has a full automatic longitudinal feed. The table can be swiveled 45 degrees in both directions and the swiveling and reversing mechanism is free from shocks.

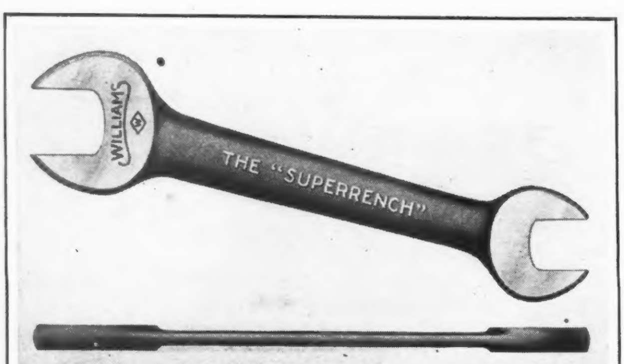
The machine is equipped with a vacuum dust-remover, which carries away the dust during the grinding operation and deposits it in a water tank at the base of the pedestal. Another feature is a rest provided at one end of the grinder head to permit the grinding of milling cutters, drills, and other tools, an independent wheel being employed for grinding this class of work. The rest is adjustable vertically. The grinding spindle is hardened and ground, and runs in long adjustable dustproof bearings made of phosphor-bronze.

On the same end as the plain grinding rest, the spindle carries interchangeable grinding-wheel arbors. A device is furnished to hold a diamond for truing the grinding wheels, and this device can be set to the desired angle. A single-pulley drive is furnished, and the machine may be driven either by belt or by a direct-connected motor, as illustrated.

Some of the principal specifications of the machine are as follows: Automatic longitudinal feed of table, 17 3/4 inches; cross adjustment of table, 6 inches; vertical adjustment of table, 9 inches; maximum distance from center of grinding spindle to face of table, 16 3/4 inches; maximum distance between centers, 21 5/8 inches; maximum diameter that can be ground between centers, 12 1/2 inches; and weight of machine, about 2270 pounds.

WILLIAMS ENGINEERS' WRENCH

The accompanying illustration shows the engineers' pattern of the line of chrome-molybdenum steel "Superrenches" manufactured by J. H. Williams & Co., Buffalo, N. Y. Several other styles of this line were illustrated in December MACHINERY. The engineers' pattern is particularly serviceable in close, cramped quarters where clearance is limited. The heads are thinner and the jaws narrower than carbon steel wrenches with the same openings; the length is ample for efficient service.



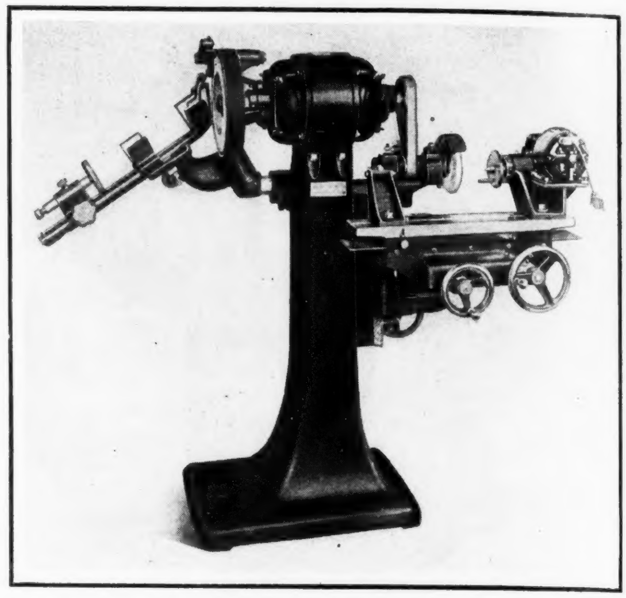
Engineers' Pattern of the New Line of Williams Chrome-molybdenum Wrenches

The openings are at an angle of 15 degrees with the handle. This makes it possible to completely rotate a hexagon nut where the swing of the wrench in turning is limited to 30 degrees. The wrench is heat-treated and nickel-finished, with the heads buffed bright.

GALLMEYER & LIVINGSTON COMBINATION GRINDER

The combination drill, cutter, and reamer grinder built by the Gallmeyer & Livingston Co., 344 Straight Ave., S.W., Grand Rapids, Mich., has been redesigned to include a motor drive. The motor is fully enclosed to eliminate dust, and is equipped with removable hand-hole covers which are convenient when making bearing adjustments, cleaning the commutator, etc. It will be noted that the drill grinding wheel is mounted on one end of the armature or rotor shaft, while the other end of the motor is utilized for driving the cutter and reamer grinding-wheel spindle. This spindle is driven through an endless belt running over pulleys of the proper size to give the increased speed necessary in the case of the small diameter wheels used in cutter and reamer grinding. Either straight or cup-wheels may be used and straight or taper work can be handled.

Longitudinal, transverse, and vertical movements are controlled by handwheels. There is a longitudinal movement of 15 inches, a transverse movement of 7 inches, and a vertical movement of 6 3/4 inches, as in the case of the previous-



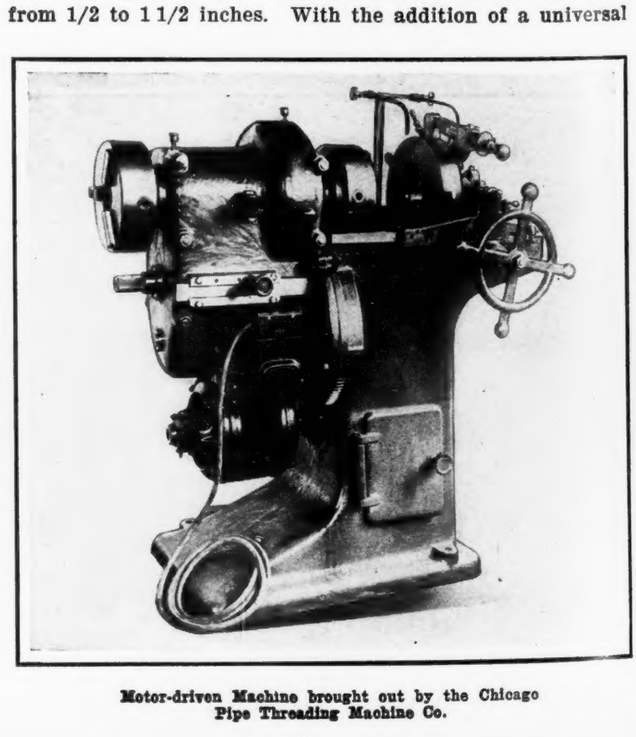
Gallmeyer & Livingston Motor-driven Combination Drill, Cutter, and Reamer Grinder

ly designed belt-driven machine. The maximum capacity of this end of the machine is for work 9 1/2 inches in diameter by 20 inches in length.

The drill grinding unit can be furnished in various capacities to suit the range of drills used. The particular machine illustrated is equipped with a holder having a capacity for drills from 1/4 to 2 1/2 inches. There is a diamond truing device and a safety stop. For handling cylindrical and internal grinding work, a special headstock driven by a small lamp-socket motor integral with the headstock is mounted on the right-hand end of the machine. The spindle of this headstock is driven by a worm which provides the required slow speed and eliminates the necessity for an overhead drum.

MOTOR-DRIVEN PIPE THREADING MACHINE

A pipe-threading machine designed to meet the requirements of both production and portable use has been placed on the market by the Chicago Pipe Threading Machine Co., 1615 Racine St., Racine, Wis. This machine is intended for pipe from 1/4 to 2 inches in size, and can also thread bolts from 1/2 to 1 1/2 inches. With the addition of a universal



Motor-driven Machine brought out by the Chicago Pipe Threading Machine Co.

drive shaft, hand stocks for pipe up to and including 12 inches can be driven.

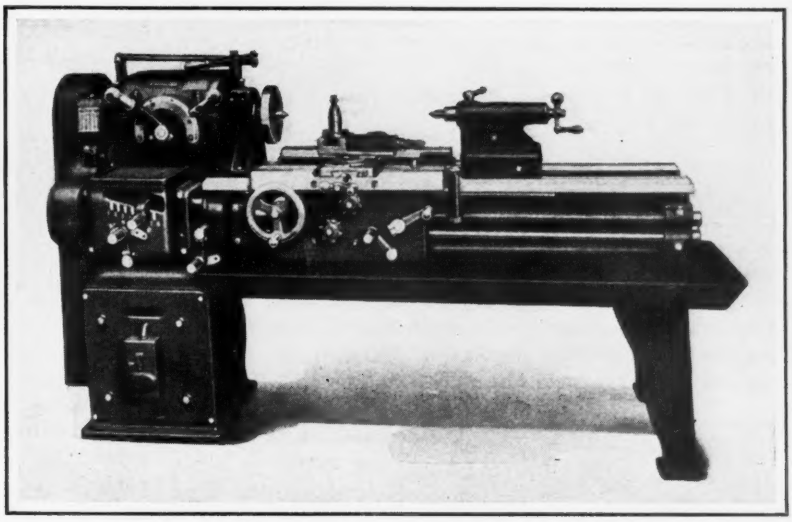
The motor is direct gear-connected and protected from all oil and chips. Three speeds are obtained through sliding gears which are lever-controlled. A clutch for starting and stopping the machine is located on the spindle, giving a control of this member independent of either the motor or the gears. A feature of the machine is that the die-slots can be replaced with little effort when worn. There is a quick-opening device, and in the handle is contained a micrometer adjustment for obtaining exact, under-size or over-size threads, as may be required. The faceplate is easily removed for cleaning the inside of the die-head and for changing dies.

At the rear of the die-head there is located a cut-off attachment which is made heavy enough to withstand the most severe shocks. All sliding parts are accurately machined and gibbed to compensate for wear. The reaming tool is mounted on the cut-off block and actuated by turning the handle toward the center of the machine after the cut, this being accomplished without changing the location of the die-head. The centering V-block is heavy and so located that the pipe cannot roll over the cut-off knife.

The spindle is of heavy construction and provided with a hole large enough for a coupling to pass through. Chucks are mounted on each end, the front chuck being equipped with pipe-holding jaws and the rear chuck being only a centering device for use with long pieces of pipe. Gripping chucks can be applied at both ends, if desired. The spindle runs in large bearings that are replaceable when worn. The oil-pump is of the centrifugal type, and runs at 1800 revolutions per minute. It is located at the lowest level of the reservoir with the result that it is primed at all times. The machine can be mounted on wheels, if desired.

CARROLL & JAMIESON MOTOR-DRIVEN LATHES

The 15- and 16-inch geared-head lathes built by the Carroll & Jamieson Machine Tool Co., Batavia, Ohio, which were described in October, 1925, MACHINERY, may now be equipped with a motor drive, the motor being located in a cabinet leg at the headstock end of the machine, as seen in the accompanying illustration. A motor of two-horsepower capacity is used for both machines, and it drives through a belt covered by a guard. Twelve selective spindle speeds ranging from 11 1/2 to 393 revolutions per minute are available through the two levers of the geared headstock. Feeds required for cutting threads from 3 to 46 per inch are obtainable through the gear-box, while a quadrant accommodates the gears necessary for cutting special threads. The machines are built in bed lengths of 6, 8, 10, 12 and 14 feet.

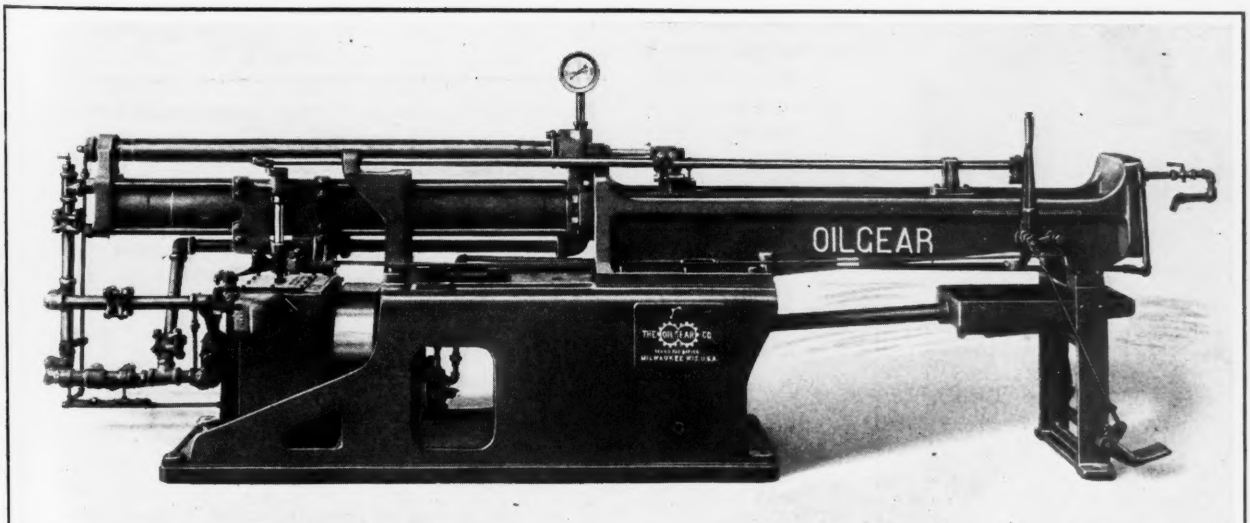


Carroll & Jamieson Geared-head Lathe with Motor in Cabinet Leg

OILGEAR HYDRAULIC BROACHING MACHINE

The improved No. 3 broaching machine now being placed on the market by the Oilgear Co., 655-667 Park St., Milwaukee, Wis., is made considerably heavier both in the base and the trough than the previous machine of this general design. The pump or power unit which operates this machine has also been improved to give a maximum pulling capacity of 25,700 pounds. The speed of both the broaching stroke and the return stroke may be varied from 48 to 360 inches per minute independently of each other. A foot-pedal control allows the operator the use of both hands at all times, and the control is such that the ram may be stopped or reversed at any point of its stroke. The machine is also equipped with a safety device that makes it impossible to break broaches on either the cutting or the return stroke. Any constant-speed source of power may be used to drive the equipment.

Several of the features claimed for this patented hydraulic broaching machine are that cuts may be started without shock, that the pull is steady without vibration, and that the speed does not vary, regardless of the resistance to the

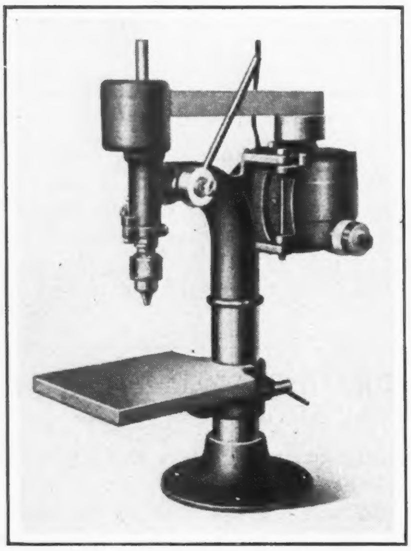


Oilgear Hydraulic Broaching Machine of Improved Design

cutting tool. There is a direct-reading pressure gage which shows at all times the amount of pull in pounds to which the broaching tool is being subjected. This makes it convenient for the operator to determine when the broach is becoming dull and needs dressing.

WINTERHOFF BENCH DRILLING MACHINE

A Junior No. 0 bench drilling machine intended for use with drills up to 3/8 inch is now manufactured by the Winterhoff Tool & Machine Co., Elkhart Ave. and Jackson St., Elkhart, Ind. This machine is equipped with a 1/4-horsepower motor running at 1750 revolutions per minute. The motor is provided with a built-in switch to eliminate outside wire connections. The driven cone pulley has a bearing at each end to obviate side thrust on the spindle, and the spindle has a long rigid bearing which is supplied with means for taking up end and side play. The spindle travels 2 1/4 inches, and has a stop with a fine-adjustment screw. The driving belt is tightened by means of a thumb-screw which pushes the motor back on the hinged support. The greatest distance from the table to the spindle nose is 7 1/2 inches, and the total height of the machine is 25 1/2 inches. The weight is 85 pounds.



Winterhoff Bench Drilling Machine

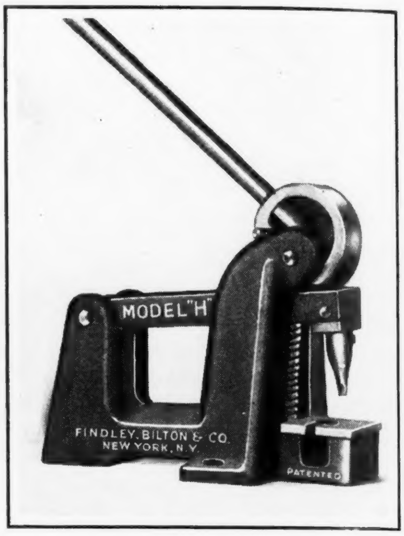
MONITOR MACHINE LIMIT SWITCH

A machine limit switch of compact design recently developed by the Monitor Controller Co., Baltimore, Md., is shown in the illustration. The over-all dimensions of this switch are 4 by 2 1/8 by 2 1/4 inches. The switch is designed to handle pilot circuits of direct- or alternating-current starters and controllers, and can be used to limit the over-travel of work, tools, etc.; as an interlock switch; and for other purposes of a like nature. This switch is made in two types, one having normally open contacts and the other, normally closed contacts. The standard construction has copper-to-copper contacts of large size which operate under a heavy contact pressure. For special applications, silver contacts can be provided.

Monitor Machine Limit Switch

"FIN BILT" CHAIN REPAIR PRESS

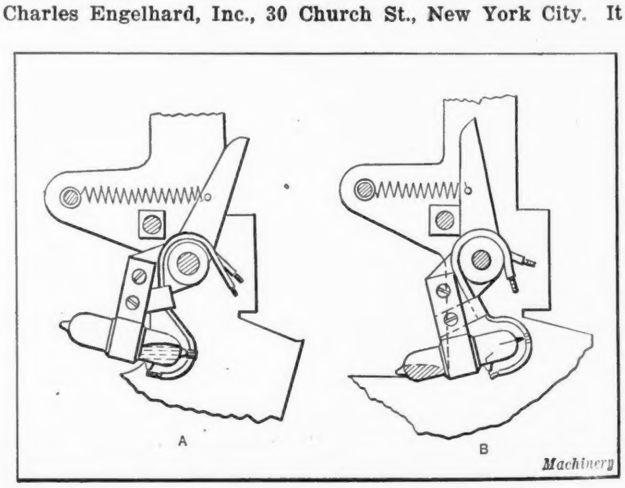
A small hand-operated press designed for use in repairing automobile skid chains has been placed on the market by Findley, Bilton & Co., 2 West 45th St., New York City. This press is equipped with two tools, one of which is used in opening links and the other in closing them. A pull of 50 pounds on the handle is said to exert a pressure of two tons on the work. It is stated that cross-links may be replaced in thirty seconds. The press is made in three sizes—the model A being intended for chain sizes from 30 by 3 1/2 inches to 35 by 5 inches; the model C, from 35 by 5 inches to 36 by 6 inches; and the model H, from 36 by 6 inches to 40 by 10 inches. The different models weigh 10, 28, and 54 pounds, respectively. The press is distributed through dealers and jobbers.



"Fin Bilt" Chain Repair Press

ENGELHARD PYROMETER RECORDER SWITCH

A mercury contact switch intended for use in connection with pyrometer recorders has recently been brought out by Charles Engelhard, Inc., 30 Church St., New York City. It is claimed that with this switch there can be no loose connections, dirty contacts, or corrosion. From the diagrams in the accompanying illustration, the operation of the switch will be easily understood. The device is simply a small glass tube containing mercury, a minute quantity of oil, and an inert gas. Platinum electrodes pass through the glass, and these are sealed.



Diagrams illustrating the Operation of the Engelhard Mercury Contact Switch

When the switch is in the position shown at *A*, the mercury makes contact with both electrodes and completes the circuit. To break the circuit, the tube is tilted slightly into the position shown at *B*, which causes the mercury to flow away from the terminals, to the other end of the tube. The maximum angle of tilt to make the mercury flow back and forth is only 15 degrees when operated with extreme slowness. If tilted quickly, as in actual practice in the pyrometer recorder, the angle is less. The switch is very small

and the energy required for the tilting so slight as to be almost negligible.

The required number of mercury contacts are all mounted side by side within the recorder case and require but little space. For example, where six records are to be made on one chart simultaneously, six mercury contact switches are employed. The resistance is from 0.003 to 0.004 ohm. The low and constant resistance of the switches, combined with their fume-proof and dustproof features, permits the recorder to be used in connection with electric resistance thermometers and thermo-couples where high precision is required.

* * *

ELIMINATION OF WASTE—A NATIONAL AIM

The progress that the United States has made during the last five years in the elimination of industrial waste on a national scale has brought about "one of the most astounding transformations in economic history," says Secretary Hoover in his annual report on the Department of Commerce. "What the country as a whole has accomplished during the last five years in increased national efficiency in these directions is impossible of measurement, nor does the Department of Commerce lay claim to credit for the great progress that has been made, save as it may have helped to organize a definite public movement. That movement is the result of the realization by every group—industrial leaders, engineers, and workers—of the fundamental importance of this business of waste elimination." The secretary also points out that wages are higher than in 1920, while wholesale prices are lower, so that we have the highest real wage in the history of the country, and have had three years of remarkable price stability. "The philosophy that underlies waste elimination," says Secretary Hoover, "has but one purpose—that is to maintain the American standard of living for both industrial workers and farmers, and to place production on a more stable footing. The high standard of living enjoyed by the American people is the result of a steadily increased production per capita. There is only one way to further advance these standards, and that is by improved methods and processes and by the elimination of waste in production and distribution."

* * *

PERMANENT MOLD CASTINGS

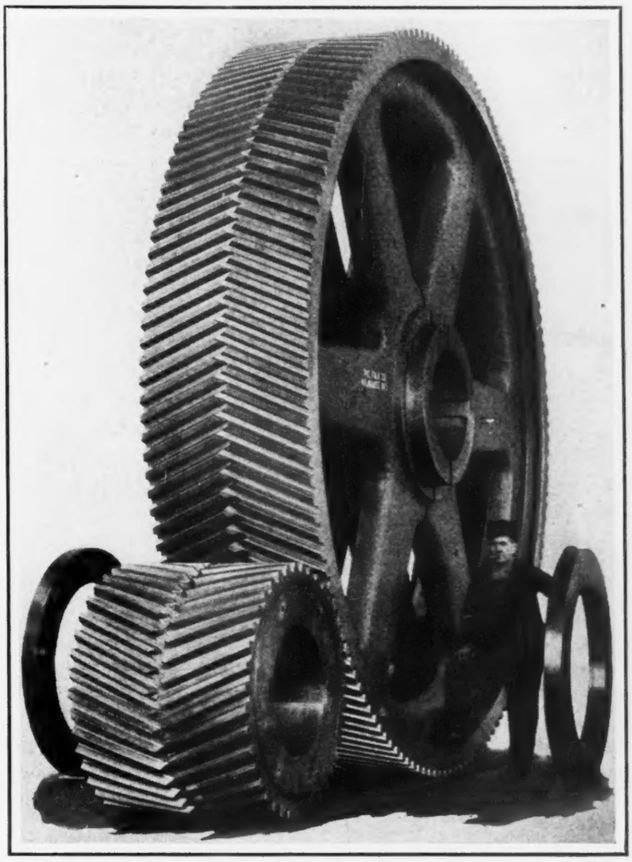
The American Foundrymen's Association, 140 S. Dearborn St., Chicago, Ill., has announced that a feature of special interest to those planning to attend the second international foundrymen's congress, which will be held in Detroit the week of September 27, will be a symposium on "Permanent and Long Life Mold Castings." This phase of foundry practice, which has assumed great importance in the last few years, will be thoroughly discussed at the meeting. The practice developed for using oil-cooled molds for pistons, the process of using zinc-impregnated molds, and many other special developments will be considered. A committee has been organized under the direction of Jesse L. Jones, metallurgist, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. The committee will welcome information from anyone who has been instrumental in developing or carrying on work in this field of casting and foundry practice.

* * *

In the review of the developments in the electrical industry during 1925 published by the General Electric Co., mention is made of the fact that the shunt brush-shifting motor was applied during the year for the first time to the operation of punch presses, draw presses, and shears. This type of machinery requires a motor having a slip higher than that of the standard squirrel-cage motor, and in the past the high-resistance type of squirrel-cage motor has been used almost exclusively for this service. However, owing to the variety of work which is handled on the average press and shears, it is highly desirable to have a motor the speed of which can be varied over a substantial range. The characteristics of the shunt brush-shifting motor meet the requirements of this service.

LARGE HERRINGBONE GEARS

The accompanying illustration shows a set of Falk herringbone gears for rolling mill drive generated by the Falk Corporation, Milwaukee, Wis. The description of these gears is: 39 and 143 teeth, 3/4 diametral pitch, 4.2 inches circular pitch, 40 inches face width, and 52 and 190.7 inches pitch diameter, respectively. These gears were furnished to the American Sheet and Tin Plate Co. in February 1921, and are operating in connection with Nordberg Uniflow engines driving sheet mills at Vendergrift, Pa. These gears are typical of several dozens of the same type and of about the same size furnished by the Falk Corporation for rolling mills during the last fourteen years. All of these gears have generated double helical teeth hobbed from solid blanks.



A Set of Falk Generated-tooth Herringbone Gears, the Gear being 15 Feet 10.7 Inches Pitch Diameter

The foregoing information will prove of interest to your readers because of a statement recently made in MACHINERY to the effect that a gear 14 feet in diameter, with a 20-inch face, 4-inch pitch was supposed to be the largest gear in the world with generated teeth.

Milwaukee, Wis. M. A. CARPENTER,
The Falk Corporation

* * *

STEAM COOLING—HONING CYLINDERS

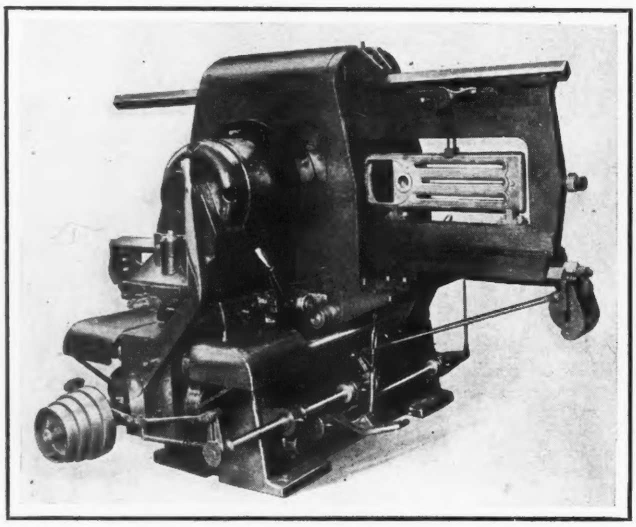
At a recent meeting of the Detroit Section of the Society of Automotive Engineers, Herbert Harrison, president of the Harrison Radiator Corporation, who has taken a prominent part in the development of engine cooling systems for many years, addressed the section on "Steam Cooling." The steam cooling system is really a water cooling system in which the water is boiled intentionally, with the radiator serving as a condenser to change the steam back into water.

At another recent meeting of the Detroit Section, the subject of lapping or honing automobile cylinder bores was discussed. The subject was dealt with by engineers of wide experience; some favored the process and some spoke against it. It was stated by some that it had been tried, found too expensive, and dropped, while others considered the improved finish well worth the extra cost.

GRINDING STEAM RADIATOR SECTIONS

On both sides of one end of the steam radiator casting in the machine seen in the accompanying illustration, there is a narrow raised rib, and on each side of the opposite end, a raised spacer boss. The two ribs and two bosses must be finished off in the same plane and parallel with the corresponding surfaces on the opposite sides. The purpose of this is to secure a tight joint and to have all castings of the radiator stand uniformly perpendicular when they are assembled in a group. These radiator castings are 26 inches long, 9 inches wide and 2 inches thick, and are cored out in the regular manner. The machine used for the operation is the No. 221 two-spindle grinder, built by the Badger Tool Co., Beloit, Wis., which is equipped with two built-in motor-driven heads, each carrying an 18-inch wheel chuck and an abrasive cylinder.

The radiator castings is supported in the fixture by two hardened V-blocks, and locked at the top by means of a quick-acting clamp. The whole fixture slides on V-ways, both at the top and bottom, and passes entirely through the machine and out at both the front and back. Operation of the fixture is accomplished by power delivered from a reduction gear-box, which is driven by a motor and provides four speeds.



Grinding Ribs and Bosses on the Two Sides of a Radiator Section simultaneously

When the clutch lever at the left-hand end of the machine is thrown over, the fixture travels at the desired speed to the end of the slide, where it automatically stops. An operator on the front side of the machine locks a casting in position and engages the clutch to send the fixture through the grinding wheels to an operator at the rear of the machine, who removes the finished casting, inserts a new one, and sends the fixture back to the man at the front.

The machine can also be operated by only one man, positioned at the front. In such a case, the operator reverses the control lever, when the piece has been ground, to return the work to him. Both sides of the casting are ground simultaneously between the two cylinder wheels, and the operation is performed dry.

The grinding heads are opened by means of the foot-treadle before the work enters between them, and when the work has been entered, the foot pressure is removed and the grinding heads closed toward the work up to micrometer stops. Special wheel-dressers are mounted on each end of the carriage. Two 7-1/2-horsepower motors fitted with the Badger end-yoke construction are used, the spindles being mounted in radial and thrust ball bearings. There is an adjustment for the grinding heads in all directions, so that the wheels can be set accurately parallel, both top and bottom, front and rear, and in alignment with the cross-travel of the carriage. The complete equipment weighs approximately 6200 pounds, and requires an operating floor space of 9 by 12 feet.

ANNUAL MEETING OF THE A. S. M. E.

The annual meeting of the American Society of Mechanical Engineers, held in the Engineering Societies Building, 29 W. 39th St., New York City, November 30 to December 4, was attended by over 2000 members. Special sessions were held by the following divisions of the society: Oil and Gas Power, Machine Shop Practice, Wood Industries, Power, Fuels, Materials Handling, Management, Aeronautic, and Textile. In addition, meetings were held under the auspices of the special research committee on metal springs, the safety committee, the committee on education and training for the industries, and the special research committee on lubrication, and on steam turbines.

Tuesday evening, December 1, the president for the past year, Dr. William F. Durand, delivered his address, and honorary memberships were conferred upon Worcester Reed Warner of the Warner & Swasey Co., and Herbert C. Hoover, Secretary of the Department of Commerce. The newly elected president for the coming year, William L. Abbott, was introduced.

Two notable lectures were delivered during the meeting, the Henry Robinson Towne lecture on "The Economic Value of Research in Pure Science," by Secretary Hoover, and the Robert Henry Thurston lecture on "Engineering and Science in the Metal Industry," by Dr. Zay Jeffries of the Aluminum Co. of America. A session was held on "National Defence" at which Elbert H. Gary presided, and at which Dwight F. Davis, Secretary of War, and Hanford MacNider, Assistant Secretary of War were speakers.

At the Machine Shop Practice Sessions, the first paper read was "The Tension Ratio and Transmissive Power of Belts," by C. A. Norman, Professor of Machine Design, Ohio State University, Columbus, Ohio. This paper gave results of an investigation made on rubber, leather, and fabric belts at the Ohio State University. These results were given in the form of curves, and the conclusions drawn from the tests were emphasized. A paper entitled "Principles and Advantages of Optical Methods for Measuring Machine Parts," was read by Henry F. Kurtz, optical engineer, Scientific Bureau, Bausch & Lomb Optical Co., Rochester, N. Y. In this paper, four classes of optical instruments were referred to, and instruments designed for shop measurements were described and illustrated.

At a second session of the Machine Shop Practice Division, a paper on "Some Comparative Wear Experiments on Cast-iron Gear Teeth," prepared by G. H. Marx, L. E. Cutter, and B. M. Green, professor of Machine Design, Associate, and Assistant Professors of Mechanical Engineering, respectively, at Stanford University, Cal., was read. The effects of the wear on the teeth were shown by photographs and measurements taken before and after the tests were made.

G. M. Eaton, chief mechanical engineer, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., read a paper on "Normal Pitch—the Index of Gear Performance." Certain departures from accepted practice which are useful in the manufacture of heavy involute gearing were described. Material improvement in performance may be secured by adopting the proper relation between the pitch of the driving and driven gears measured at the point of tooth engagement.

Forrest E. Cardullo, chief engineer of the G. A. Gray Co., Cincinnati, Ohio, presented a paper on "Question Marks in Machine Design." This paper was published in December MACHINERY, page 277. Copies of the papers read may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

In connection with the annual meeting, joint meetings were held with the American Society of Refrigerating Engineers and with the Taylor Society. The Fourth National Exposition of Power and Mechanical Engineering was also held at the Grand Central Palace during the same week as the annual meeting.

Excursions were arranged to the plant of the De La Vergne Machine Co., the Lee Spring Co., the Steinway Piano Factories, and the Bethlehem Steel Co.

GRINDING PISTON-RINGS AND COIL SPRINGS

Twenty-four hundred piston-rings, 3 1/2 inches in diameter by 1/8 inch thick, are averaged per hour in the machine illustrated in Fig. 1, which is used to rough-grind both faces of the rings simultaneously. About 0.008 inch of stock is removed from each side, the limits being plus or minus 0.0015 inch on the thickness; the faces must be parallel within 0.001 inch. The machine is the regular No. 6 belt-driven wet two-wheel disk grinder built by Charles H. Besly & Co., 120-B N. Clinton St., Chicago, Ill., equipped with a work-feeding fixture which automatically slides the rings between the wheels.

The feeding fixture is attached to a T-slotted pad on the front of the machine and to a pad on the rear of the water hood. The piston-rings are placed in a V-shaped trough mounted horizontally on the left-hand side of the feeding fixture, as illustrated. From this trough they are fed into the fixture by a sliding member which is operated through a cable-and-weight opening-and-closing device. Rams on a slide then feed the piston-rings into the machine, and as each ring is fed, the left-hand wheel-spindle is slightly withdrawn from its positive working position. As soon as the ring has been fed forward about three-fourths of its diameter, the spindle is released and the wheel is moved into position to grind the work. The forward movement is controlled by a weight feed that is positive at all times. At the rear of the machine, the pistons pass into a chute which conveys them close to the front at the right-hand end, as may be seen in Fig. 1, where they are convenient to the operator for inspection. Adjustment of the spindles for sizing the work is controlled by micrometer screws at each end of the machine.

The slide that carries the feeding rams is mounted in a guide casting and held in place by means of adjustable gibs. The top gib holds the slide in suspension, and also acts as a side bearing. This mounting keeps the wearing parts free from grit and slush. The feeding rams are attached to the inner end of the slide and vary in width and thickness according to the rings to be ground. The work-supporting bars may be of various sizes, and extend through between the grinding wheels. An adjustable floating guide bar mounted directly over the bar on which the work moves prevents the work from being forced upward in grinding.

The work-feeding fixture is driven by a one-third horsepower motor, but it could be driven by belt direct from a countershaft. The grinding wheels are 20 inches in diameter, and are standard steel disk wheels equipped with "Titan" grinding disks. Cooling lubricant is pumped from a three-compartment settling tank at the rear of the machine to the outer end of each spindle, which is fitted with a running connection. The lubricant is then conveyed through the center of the spindles and spreads out over the entire face of the grinding disks. Fig. 1 shows the machine with the right-hand head drawn back to permit a view of the relative position of the rings between the grinding wheels when the machine is in operation.

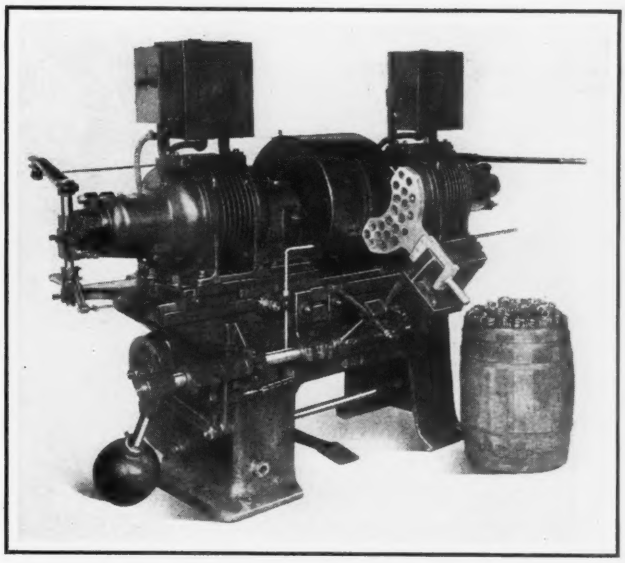


Fig. 2. Grinding Both Ends of Twenty Coil Springs simultaneously

Fig. 2 shows a motor-driven No. 6 dry ring-wheel grinding machine built by the same company for grinding both ends of short coil springs. This machine is equipped with 18-inch wheels and a power-driven oscillating fixture and work-holder. The coil springs are 1 5/16 inches in diameter by 1 1/4 inches long, and are made from 3/16-inch wire. Twenty springs are ground on both ends in one operation, the ends being ground to a given length, or enough stock removed to give the springs a good bearing seat on each end.

Two detachable work-holders are generally used in operating a machine of this type on production work. The operator places a loaded holder in the socket of the oscillating fixture, opens the grinding wheels by means of the foot-lever, pushes the fixture forward between them, and at the same time releases a locking device which engages the fixture. The foot-lever is then released and the grinding begins. While the grinding is in process, the operator loads the second holder, and when this has been done, he withdraws the locking bolt, pulls back the fixture from between the wheels, removes the work-holder from the machine, and replaces it with the second loaded holder, after which the operation goes on as before. The production with the springs shown is 1600 pieces per hour, ground on both ends.

The machine itself is of standard construction and driven by 7 1/2-horsepower motors. The wheel-spindles are operated outward by the foot-lever, and automatically closed on the work by means of a weight feed. The oscillating fixture is operated by a connecting-rod attached to a motor-driven reduction gear unit mounted on the rear of the base, and the oscillating motion can be adjusted to meet the requirements of the work being ground. Hardened steel holders are used for very short springs, aluminum steel-bushed holders for medium length springs, and fabricated holders for long springs.

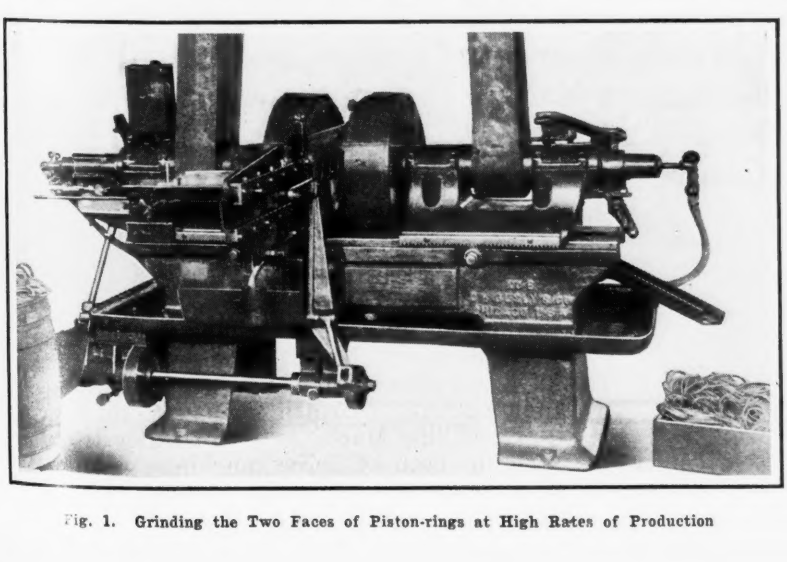


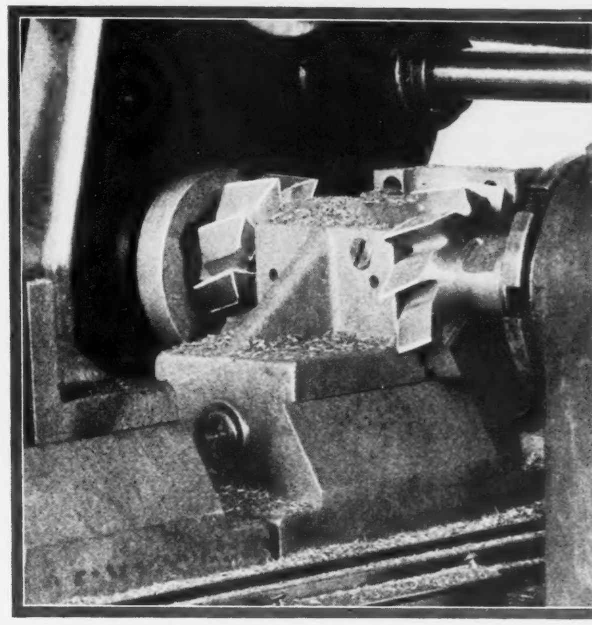
Fig. 1. Grinding the Two Faces of Piston-rings at High Rates of Production

* * *

GERMAN STANDARDS FOR FITS

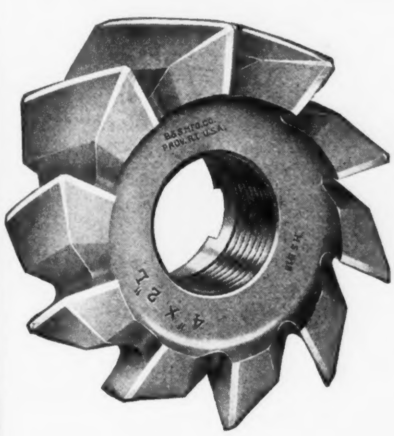
A book of over 200 pages relating to German standards for fits has been published by Dinorm, Berlin, N.W. 7, Germany. The work is in the German language. It is published under the auspices of the Standardization Commission of the German industry, and may be obtained from Beuth-Verlag, Berlin, S.W. 19. The price is 5.50 marks.

And—
the manufacturer choose Brown & Sharpe Cutters— because their longer cutting efficiency between sharpenings gives a greater profit assurance.



The manufacturer for whom the No. 21 Automatic solved the Crankshaft Bearing Cap production problem chose Brown & Sharpe Coarse Tooth Spiral Shell End Mills as a vital part of the equipment.

The job required a cutter of small diameter to take a fast face-milling cut and the Shell End Mill not only offered the correct design, but the Brown & Sharpe quality of standing up longer between sharpenings. Brown & Sharpe Cutters are chosen for many reasons—because the steel used is the finest yet developed, because of their modern, highly efficient design, and because they are skillfully heat-treated according to methods developed during three-quarters of a century of active experience.



Note the well relieved, sturdily backed up teeth and the ample chip space of this standard Brown & Sharpe Spiral Shell End Mill.

And, finally, Brown & Sharpe Cutters are chosen by manufacturers because there is a certainty of eventual profit in using them.

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

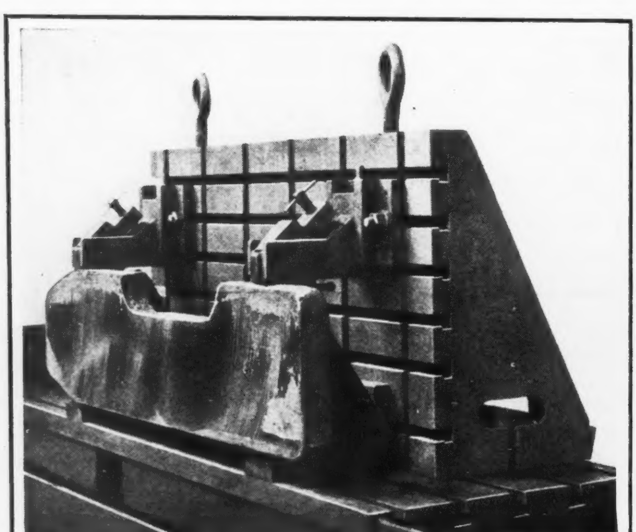
If you have not already received a copy, Catalog No. 29 will acquaint you with our complete line of 45 styles and over 2000 sizes of cutters. Write for a copy to-day.

SAVINGS MADE BY FACE GRINDING

By J. F. FEEHERY, Westinghouse Electric & Mfg. Co., Philadelphia, Pa.

With the introduction of face grinding in our shops, we set out to reduce the amount of stock allowed on surfaces for finish by planing or milling to what was considered desirable for a grinding finish. A face grinder built by the Diamond Machine Co. is used, and the line of castings ground consists principally of condenser manhole covers, bearing covers, joints of gland rings, oil-ring and water guides, cylinder blocks, cylinder heads, pedestals, and other parts. On most of these castings a minimum finish of 1/8 inch was specified, but when the castings were received in the shop, it was found that usually from 3/16 to 1/4 inch of material had to be removed from the surfaces. To offset this increased amount of finish caused by rapping in the foundry, we reduced the specified amount to the minimum. In some cases where a flange thickness permits a variation of 1/16 inch, no finish is allowed whatever, and on other flanges and castings held to closer limits, from 1/16 to 1/8 inch of finish is allowed, depending upon the shape and size of the castings.

The essential factors in obtaining maximum production from a grinding machine are that a wheel of proper grade and grain for the average run of work handled by the machine be provided. The wheel should be neither too hard nor too soft; in other words, it should be of a mean grade and grain. The accompanying table shows the time taken to remove the various thicknesses of metal, and indicates the saving that can be made in labor and material by reducing to the minimum the amount of finish specified on castings. The table also shows the increased production that can be obtained. The instance where 128 square inches of surface were ground may be used as an illustration; the time required to remove 1/8 inch thickness of stock from this surface was 5.5 minutes, and the amount of material removed, 4.16 pounds. The cost of this material in the open market would be about 21 cents; the cost of labor for the operation in an average shop, 7 cents; and the overhead cost, 10 cents. This makes a total cost of 38 cents.



Work-holding Fixture which has increased the Production of Face Grinding Machines

The time shown for the removal of the various amounts of stock, however, does not include the time required for finish-grinding, as this time is governed by the quality of finish desired. It is a well recognized fact that in face grinding, the wheel grinds freer and removes more stock as it approaches and leaves the work than it does when the full surface of the wheel is in contact with the work. It is the straightening of the surface that requires the additional time referred to. If the surface is to be ground straight within a tolerance of from 0.0015 to 0.002 inch, the time, of course, will be proportionately higher than if the surface is to be ground straight only within from 0.010 to 0.015 inch. In many instances face grinding in our plant has increased production 75 per cent over previous methods.

The illustration shows a work-holding fixture designed for use on the face grinder. This fixture handles a large variety of work without the use of clamps, bolts, or blocking, and does away with the necessity of special fixtures. By the use of this fixture, the time required for loading and unloading has been reduced so that the production has been increased from 15 to 25 per cent. The body of the fixture is a rigid angle-plate having six T-slots machined vertically and six horizontally, so that four clamping members may be easily adjusted on it to any desired position. The upper members consist of a fulcrumed clamping lever actuated by a jack-screw. A self-aligning clamping jaw is inserted in the lever, the jaw being hardened and serrated and adjusting itself to the work. The clamping member has a stop-screw and an adjustable positive stop. The lower members have hardened serrated plates on which the work is clamped. There are stop-screws for work ground on one side only, and adjustable positive stops for use in grinding the second side of straight work on which both sides are ground.

DATA SHOWING TIME AND MATERIAL SAVED BY FACE GRINDING

Kind of Metal	Ground Area, Square Inches	Width of Ground Surface, Inches	Thickness of Metal Removed, Inch	Weight of Metal Removed, Pounds	Time Consumed, Minutes
Cast iron..	52	3	5/32	2.11	3.66
Cast iron..	128	4	1/8	4.16	5.50
Cast iron..	17.5	5 1/4	1/8	0.57	1.75
Cast iron..	42	3	7/32	2.38	6.00
Cast iron..	115	15 1/2	21/64	9.80	14.50
Aluminum.	87	2 1/4	1/8	1.04	3.10
Aluminum.	27	1 5/16	1/8	0.32	1.80

Machinery

* * *

STANDARDIZATION OF CHASERS FOR SELF-OPENING DIES

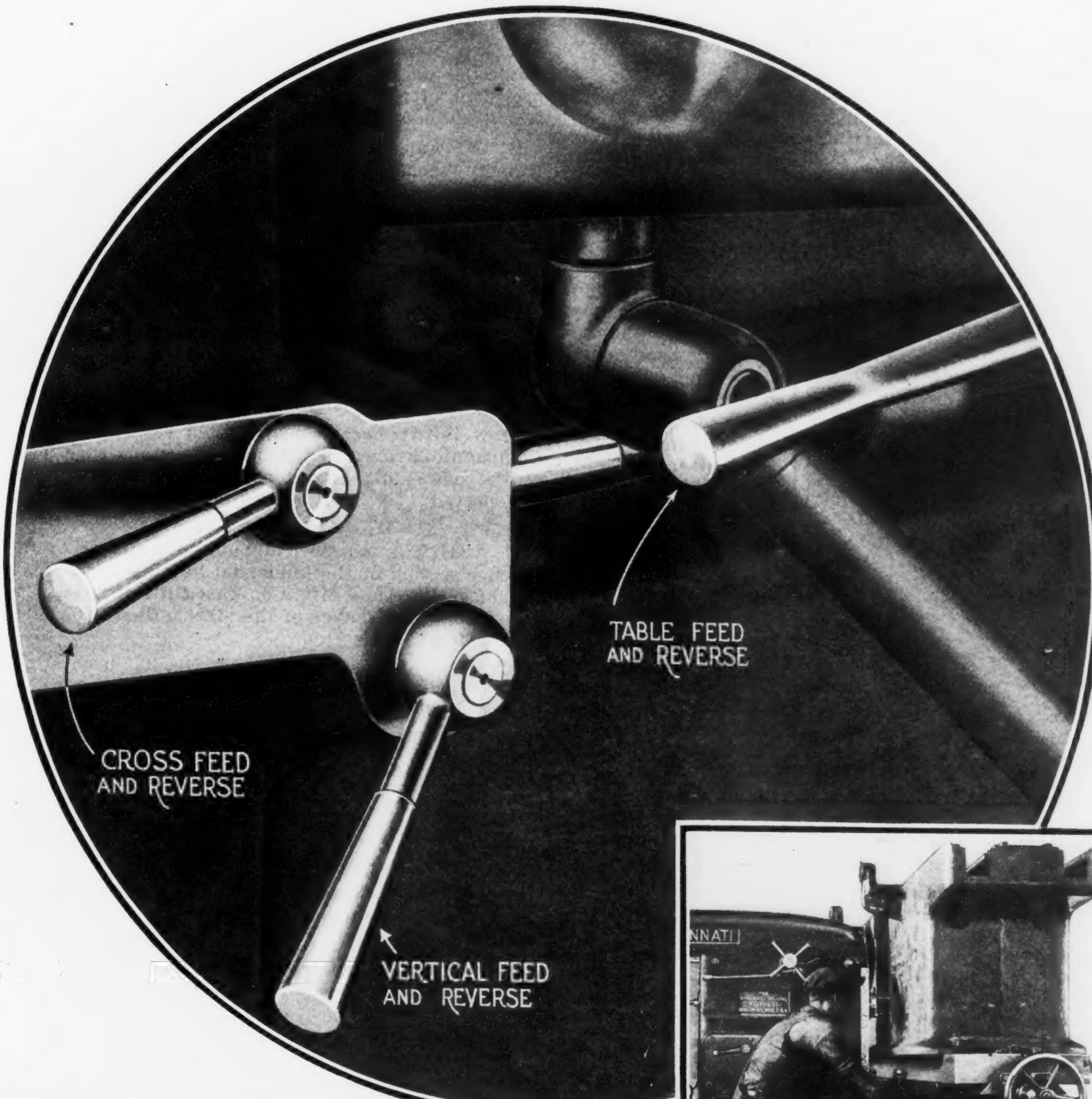
Recommendations that will mean a reduction of 75 per cent in the sizes and varieties of chasers for self-opening die heads, used in automatic screw cutting machinery, were adopted on December 4 by a general conference of manufacturers, distributors, and users held under the auspices of the Division of Simplified Practice of the Department of Commerce.

This product, the manufactured value of which amounts to some $5,000,000 annually, is used in a wide range of mechanical goods, from sewing machines to locomotives. The program adopted by the conference is estimated to make possible a potential saving of $500,000 a year in manufacture and distribution, and a large indirect saving to every user of machine screws, through interchangeability of parts. The simplification is in line with the work done by the National Screw Thread Commission and the American Engineering Standards Committee, and is a step toward further standardization in the field of mechanics.

After discussions of the program by members of the Screw Thread Commission, the American Railway Association, the American Electric Railway Association, the American Society of Mechanical Engineers, and others, the recommendations were adopted, to become effective April 1, 1926, and to be in effect for a year. A standing committee comprising representatives of the manufacturers, the machine tool builders, mill supply dealers, and large consuming groups will be named to observe the application of the simplifications, to receive suggestions, and to develop further eliminations.

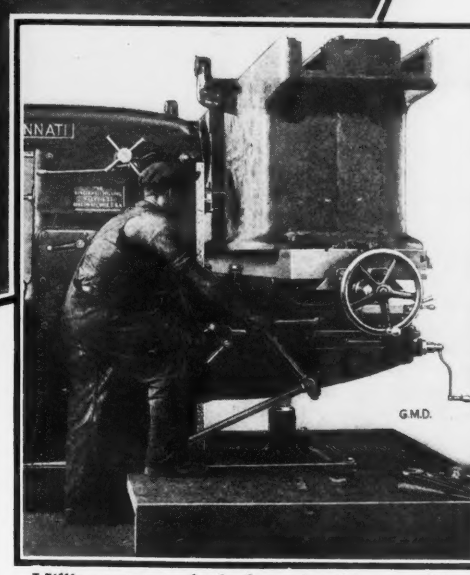
* * *

The average number of persons employed by Class I steam railways, excluding switching and terminal companies, during the year 1924 was 1,751,324, and the total compensation amounted to $2,826,025,230, which was 62.69 per cent of the total operating expenses of that class of roads for the year.



COMPLETE
REAR CONTROL

On jobs like this it is absolutely necessary for the operator to watch the cutter at work. This exclusive patented feature on Cincinnati 4 and 5 High Power Millers is a time saver—a preventive of spoiled work—and a big feature speeding production. Another reason why operators ask for Cincinnati Millers!



Milling parts on bed of woodworking machine

"Why hamper your Skilled Operators with obsolete equipment?"

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI·OHIO·U·S·A·

CINCINNATI MILLERS

WORCESTER R. WARNER HONORED BY THE A. S. M. E.

On the opening day of the annual meeting of the American Society of Mechanical Engineers, December 1, Worcester Reed Warner of the Warner & Swasey Co., Cleveland, Ohio, a well-known mechanical engineer and manufacturer, was made an honorary member of the society at the same time that honorary membership was conferred upon Secretary Herbert Hoover. This is the highest distinction that can be conferred upon a prominent engineer by the American Society of Mechanical Engineers.

Mr. Warner was born in Cummington, Mass., May 16, 1846. After learning the machinist's trade in Boston and Exeter, N. H., he was with the Pratt & Whitney Co., Hartford, Conn., from 1870 to 1880. At the same time he studied astronomy and other sciences, and experimented with the building of telescopes as a recreation. In 1881 he formed a partnership with Ambrose Swasey, this being the beginning of the Warner & Swasey Co. of Cleveland, Ohio, well-known manufacturers of machine tools and of instruments of precision, including range finders, gun sights, field telescopes, binoculars, as well as of astronomical instruments. In the latter field the company has achieved a well earned reputation, having designed and constructed the mountings for the largest refracting telescopes in the world, including those at the Washington Naval, Lick, and Yerkes Observatories, in addition to others for the Canadian Government and lesser equipment for college observatories.

Mr. Warner is also a leading figure in the business, financial and general community life of Cleveland. He is vice-president of the Society for Savings, director of the Guardian Trust Co., member of the Advisory Board of the Citizens Savings and Loan Co., trustee of the Case School of Applied Science, of the Adelbert College of the Western Reserve University, and of the Cleveland School of Art, member of the Advisory Board of the Art Museum, and past-president of the Cleveland Chamber of Commerce.

In engineering societies Mr. Warner has taken a very active part. He is a charter member and past-president of the American Society of Mechanical Engineers, having been active in its founding in 1880. He is also a member of the British Astronomical Society, the American Astronomical and Astro-physical Society, and a fellow of the Royal Astronomical Society and of the American Association for the Advancement of Science. He has received the unusual degree of Doctor of Mechanical Science.

* * *

PERSONALS

David Ayr has been made factory manager of the Pratt & Whitney Co., Hartford, Conn.

Frank O. Hoagland has been appointed master mechanic of the Pratt & Whitney Co., Hartford, Conn.

Charles P. Clark has been appointed assistant general manager of the American Automobile Association, Penn Ave. at 17th St., Washington, D. C.

John P. Lacey, Seneca Falls, N. Y., sales and industrial engineer, has taken over exclusive distribution throughout the world of the Thorn portable demagnetizer.

K. D. McKoll of Forest, Ontario, Canada, will represent the United States Electrical Tool Co., Cincinnati, Ohio, as its Canadian district manager, with offices in Toronto.

Donald B. Fullerton, 520 W. 7th St., Plainfield, N. J., has resigned from the Niles-Bement-Pond Co., New York City, where he has been in general charge of the Maag gear department.

H. A. Watkins has recently been appointed Metropolitan district sales manager for the Bridgeport Brass Co., Bridgeport, Conn., and will make his headquarters in the Pershing Square Building, New York City.

Henry C. Houck, assistant general merchandise manager of the General Electric Co., Schenectady, N. Y., has been appointed manager of the merchandise department at the Bridgeport Works of the company.

Ray A. Sossong, manager of gas plants of the Air Reduction Sales Co., 342 Madison Ave., New York City, was elected president of the International Acetylene Association at the recent annual convention in Chicago.

G. H. Fristoe, formerly connected with the Stocker-Rumely-Wachs Co. of Chicago, Ill., assumed charge of the sales department of the Riverside Machinery Depot, 251 St. Aubin Ave., Detroit, Mich., on December 1.

J. B. Beattie, formerly connected with the Autocar Co., has been appointed eastern sales manager, with headquarters in New York City, of the Lapeer Trailer Corporation, Lapeer, Mich., manufacturer of automatic semi-trailers.

James W. Sneyd, who has for fourteen years been connected with the National Acme Co., at Cleveland, has resigned as manager of their die department and is now connected with the Geometric Tool Co. at New Haven, Conn.

Jean Boyau has been appointed resident engineer of the Compagnie Francaise Thomson-Houston, with headquarters at the offices of the International General Electric Co. at Schenectady, N. Y., succeeding Jean Canivet who was drowned July 10.

E. A. Hurme has been appointed manager of the electric furnace section of the industrial heating section of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Mr. Hurme was formerly manager of the steel mill section of the industrial sales organization.

O. T. Muehlemeyer, Rockford, Ill., has been appointed district manager for Illinois, Iowa, and Wisconsin, of the Rodman Chemical Co., Verona, Pa., manufacturer of carburizer compounds, quenching and tempering oils. Mr. Muehlemeyer was formerly metallurgist of the Barber-Colman Co., Rockford, Ill.

J. N. Walker has been appointed general sales manager of the Oxweld Acetylene Co., 30 E. 42nd St., New York City. L. D. Burnett has been appointed eastern department sales manager, succeeding Mr. Walker, and Z. T. Davis, Jr., will fill Mr. Burnett's former place as assistant sales manager in the eastern department.

Major Earle Buckingham, who for the last seven years has been connected with the Pratt & Whitney Co., Hartford, Conn., and the Niles-Bement-Pond Co., New York City, in various engineering capacities, is leaving this connection to join the faculty of the mechanical engineering department of the Massachusetts Institute of Technology.

Charles L. Wood, formerly assistant general manager of sales of the Carnegie Steel Co., Pittsburg, Pa., has been appointed general manager of sales to succeed William G. Clyde, recently appointed president of the company. Samuel R. Hoover has been made assistant general manager of sales, in charge of the bureau of bars and hoops, to succeed Mr. Wood.

Frederick V. Lindsey has been appointed sales manager of resistance materials of the Driver-Harris Co., Harrison, N. J. Mr. Lindsey has been identified with the manufacture of nickel and nickel alloys for many years, having been vice-president and secretary of the Electrical Alloy Co. previous to its purchase by the Driver-Harris Co. His efforts will be concentrated on the manufacture and sale of "Nichrome" for industrial and domestic applications.

J. W. Myers, formerly connected with the National Acme Co., and later manager of the machinery department of the Andrews & George Co., Tokyo, Japan, has resigned, and is now returning to the United States to make connections with manufacturers who desire to extend their business in the Far East. He is mostly interested in promoting business as factory representative. Mr. Myers will make his headquarters at the Winton Hotel, Cleveland, Ohio.

Thomas Vaughn, formerly mechanical engineer with the R. D. Nuttall Co. and later sales representative for Manning, Maxwell & Moore in the Pittsburg district, has recently become associated with the Pittsburg Gear & Machine Co., Pittsburg, Pa., as engineering sales representative. Mr. Vaughn's previous experience especially qualifies him to give service on problems connected with G-E "Fabroil" and "Textolite" gears and Whitney silent chain, for which the Pittsburg Gear & Machine Co. is exclusive representative in this territory.

W. J. Nugent, vice-president and general manager of the Nugent Steel Castings Co., Chicago, Ill., has been elected president to succeed Charles Piez. Prentiss Coonley has been elected vice-president, and C. A. MacDonald, secretary, has been elected to fill a vacancy on the board of directors. Mr. Nugent has been associated with the company since 1918, when the present plant was erected. From 1918 to 1921 he served as vice-president, and in 1921 became general manager as well. The interests of Mr. Piez have been taken over by Mr. Nugent and others.

H. A. Baxter has been appointed manager of the steel sales department of Henry Disston & Sons, Inc., Philadelphia, Pa., manufacturers of saws, tools, and steel. Mr. Baxter succeeds Charles T. Evans, who has retired on account of poor health after many years as manager of the department. Mr. Baxter has been general manager of sales for the Tacony Steel Co. and the Penn Seaboard Steel Corporation, of Philadelphia, for the last three years. Prior to that, he was associated with the H. H. Franklin Automobile Co., the Midvale Steel Co., and the Tacony Ordnance Corporation.

George P. Baldwin, general merchandising manager of the General Electric Co., Schenectady, N. Y., was elected a vice-president of the company at a recent meeting of the executive committee. Mr. Baldwin will have charge of the activities connected with the electrification of steam railroads. His headquarters will be at 120 Broadway, New York City. Charles E. Patterson, vice-president, in charge of finance since 1920, will take charge of all merchandising activities of the company, and will make his headquarters at Bridgeport, Conn. The accounting department responsibilities of Mr. Patterson will be assumed by the comptroller, S. L. Whitestone.

* * *

TRADE NOTES

Moore Special Tool Co., 358 John St., Bridgeport, Conn., has acquired the manufacturing and selling rights for the Williard spring tool-holders.

American Equipment Co., Detroit, Mich., has taken the agency in Metropolitan Detroit for the electrical drills, grinders, and polishers made by the United States Electrical Tool Co., Cincinnati, Ohio.

Bonney Forge & Tool Works, Allentown, Pa., manufacturers of chrome-vanadium steel drop-forged wrenches, are adding a new building, 110 by 200 feet, to their plant. The building will soon be completed and will provide needed facilities to accommodate an increased business.

Smith & Hemenway Co., Inc., Irvington, N. J., manufacturer of "Red Devil" tools, announces that J. F. Hemenway has retired, his entire interest having been purchased by Landon P. Smith, president of the company. The facilities of the plant will be increased and improved machinery installed.

International Harvester Co. has awarded the Austin Co., Cleveland, Ohio, a contract for the design and construction of a large new unit to be added to its Milwaukee plant. The new building will be of one-story steel frame design, 145 by 200 feet, and will house drying ovens and be used for storage purposes.

Tool Equipment Sales Co., 18 S. Clinton St., Chicago, Ill., has been appointed exclusive factory representative of the Bicknell-Thomas Co., Greenfield, Mass., manufacturer of tapping equipment. A complete stock of this company's products will be maintained at the store of the Tool Equipment Sales Co.

Chemical Treatment Co., Inc., 26 Broadway, New York City, producer of "Crodon"—a chrome alloy plate—has recently purchased another plant at Waterbury, Conn., which will become plant No. 2 of this company's production units. The buildings just acquired offer 24,000 square feet of floor space.

Star Tool & Die Works, Detroit, Mich., formerly located on Beaubein St., are now in their new building at 2520-24th St., which affords them approximately 10,000 feet of floor space. The new quarters will give them added facilities for the handling of contract machine work and the manufacture of punches and dies.

Oilgear Co., 655-667 Park St., Milwaukee, Wis., has just finished an addition to the company's plant, increasing the effective floor space from 14,500 square feet to 36,000 square feet. This will give the company additional facilities in the manufacture of hydraulic broaching machines, hydraulic power presses, and hydraulic variable-speed transmissions.

R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, has appointed the following new agents: New York territory, Wilson-Brown, Inc.; Chicago, Federal Machinery Sales Co.; St. Louis, J. J. O'Brien Machinery Co.; Pittsburg, Laughlin-Barney Machinery Co.; Philadelphia, Stoer Machinery Co.; Birmingham, Moore-Handley Hardware Co.; Buffalo, Rochester, and Syracuse, Crane-Schiefer-Owens Co.

Mount Morris Valve Corporation, Mount Morris, N. Y., has purchased the patterns, good-will, trademark rights, etc., of the McNab & Harlin Mfg. Co., applying to the standard line of M H brass valves. The Mount Morris Valve Corporation has erected a modern fireproof foundry and shop building on a large tract of land located on the main line of the Lackawanna Railroad for the manufacture of this product.

N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill., have appointed the Machinists' Supply Co., of Pittsburg, Pa., distributor for their line of flexible shafts and equipment throughout the western half of the state of Pennsylvania and the northwestern part of the state of West Virginia. Beals, McCarthy & Rogers, Inc., of Buffalo, N. Y., will serve as distributors for the western part of the state of New York.

Grobet File Corporation of America, 64 Reade St., New York City, has just introduced on the American market increment cut files made to American standards in shape, size, and cut, but having the special features of design and manufacture of the Grobet Swiss files made by F. L. Grobet. The principal feature of the increment cut files is their staggered teeth, which are similar to the teeth of a file cut by hand.

United States Electrical Tool Co., Cincinnati, Ohio, has opened a New England office at 514 Atlantic Ave., Boston, Mass. Ralph E. Bell has been appointed district manager for New England and will have charge of this office. The company announces that it has withdrawn its selling arrangements with the Backmeier Sales Corporation, of Cincinnati, and will have its own salesmen travel through the southern states in the future.

Kent Machine Co., Kent, Ohio, has purchased the business of the Falls Clutch & Machinery Co., of Cuyahoga Falls, Ohio. The office of the latter company will be removed to Kent, but the manufacture of transmission machinery will be carried on at both plants, thereby greatly increasing the production facilities of the company, and adding to the effectiveness of its service. The officers of the Kent Machine Co. are: President, M. G. Garrison; vice-president, J. G. Getz; treasurer, R. H. Smith; and general manager, S. B. Beck.

Chicago Pipe Threading Machine Co., 1615 Racine St., Racine, Wis., has been formed for the purpose of manufacturing and marketing a new pipe threading machine. Charles Rasmussen and R. T. Ingalls, owners of the Wisconsin Machinery Co. of Racine, Wis., and builders of the "Peerless" line of power metal sawing machines, together with L. H. Taylor, formerly of the Greenfield Tap & Die Co., of Greenfield, Mass., and the Williams Tool Corporation, of Erie, Pa., and Clifford Peterson, of the Clifford Peterson Tool Co., of Chicago, Ill., are the incorporators and owners.

General Electric Co., Schenectady, N. Y., announces that the company has decided to purchase a site for a manufacturing establishment in St. Louis, Mo. The tract of land selected contains about 155 acres, of which all but 11 acres are within the city limits of St. Louis. The rapid growth of the use of electricity in this section of the country is the reason for the location of a manufacturing plant of the General Electric Co. in St. Louis, but it has not yet been decided what character of apparatus will be manufactured in the plant to be erected there.

The Standard Steel Specialty Co., Beaver Falls, Pa., has been organized for the purpose of specializing in the manufacture and sale of machine keys, Woodruff keys, machine racks, taper pins, and machined steel sections. Arrangements have been concluded with the Union Drawn Steel Co., Beaver Falls, Pa., owner of the Standard Gauge Steel Co., whereby the new company has taken over that part of the Union Drawn Steel Co.'s business devoted to the manufacture of the products mentioned. Manufacturing operations will be carried on in the present location until the spring of 1926, when a new plant will be erected. E. J. Wagner, formerly secretary and general manager of the Standard Gauge Steel Co., is heading the new company.

Oakley Chemical Co. held its ninth annual conference on industrial cleaning December 7 to 10, inclusive, at the Hotel Pennsylvania and at the company's offices at 26 Thames St., New York City, at which nearly one hundred men of the technical laboratory, sales and service staff were present, including the seventy field service men employed by the company. A carefully planned program of a large number of technical papers dealt with cleaning methods in all the major industries, including metal cleaning in machine shops, automobile plants, railroads, textile plants, and numerous other industrial undertakings. Group sessions relating to each of the major industries were also held, at which the men interested in specific industries had an opportunity of exchanging ideas.

COMING EVENTS

JANUARY 9-16—National Automobile Show to be held at the Grand Central Palace, New York City.

JANUARY 11—Meeting of National Pressed Metal Society at 8 P. M. at the City Club, 315 Plymouth Court, Chicago, Ill. Everyone interested in pressed metal work is invited to attend. Further information may be obtained from R. W. Sayre, 53 Bellevue Place, Chicago, Ill.

JANUARY 11-13—Second World Motor Transport Congress to be held in New York City during the National Automobile Show. Sponsored by the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

JANUARY 20-22—Annual meeting of the Society of Automotive Engineers to be held in Detroit, Mich. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

JANUARY 21-22—Winter sectional meeting of the American Society for Steel Treating at Buffalo, N. Y. Secretary, W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio.

JANUARY 30-FEBRUARY 6—National Automobile Show, to be held at the Coliseum, Chicago, Ill.

MARCH 17-23—First national heating and ventilating exposition, including plumbing, refrigeration and illumination, at the New Madison Square Garden, Eighth Ave. and 49th St., New York City. Executive offices of the exposition, Suite 334, Hotel McAlpin, New York City.

APRIL 6-8—Third annual convention and exposition of the American Oil Burner Association in Detroit, Mich. Headquarters, Book Cadillac Hotel. Executive secretary, Leod D. Becker, 350 Madison Ave., New York City.

JUNE 19-26—Convention and exhibit of the Mechanical Division, American Railway Association, Young Million Dollar Pier, Atlantic City, N. J. Secretary of the Mechanical Division: V. R. Hawthorne, 431 S. Dearborn St., Chicago, Ill. Secretary-treasurer of the exhibit: J. D. Conway, 1841 Oliver Bldg., Pittsburg, Pa.

JUNE 21-25. Twenty-ninth annual meeting of the American Society for Testing Materials at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. Secretary's address, 1315 Spruce St., Philadelphia, Pa.

SEPTEMBER 27-OCTOBER 2—Annual convention of the American Foundrymen's Association and second international foundry congress in Detroit, Mich. In conjunction with these conventions there will be held an international exposition of foundry and machine shop equipment and supplies. C. E. Hoyt, secretary-treasurer, 140 S. Dearborn St., Chicago, Ill.

NEW BOOKS AND PAMPHLETS

A. S. T. M. TENTATIVE STANDARDS (1925). 876 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price, paper binding, $7; cloth binding, $8.

RADIO TELEPHONE MODULATION. By Hugh A. Brown and Charles A. Keener. 49 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 148 of the Engineering Experiment Station.

AERONAUTICAL METEOROLOGY. By Willis R. Gregg. 144 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $2.50.

In view of the increasing importance of aeronautics, the Ronald Press Co. has undertaken to supply the need for literature on this subject by the publication of an Aeronautic Library, of which this is the first volume. The purpose of this book is to supply the aeronautical engineer with knowledge of the characteristics of the atmosphere, including variations in density, pressure, and temperature with height; the direction and velocity of winds, and frequency of winds at different altitudes; size and other characteristics of thunderstorms; characteristics of cyclones, etc. The aim is to give in concise handbook form the essential facts of the upper air, and to point out their relation to the development and safety of aeronautics. It embodies the results of the most recent aerological research.

INDUSTRIAL FURNACES. By W. Trinks. 405 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 432 Fourth Ave., New York City. Price, $5.50, net.

This is the second volume of a work on industrial furnaces, but the present book, although a continuation of the first, is complete in itself. The first volume contains a great deal of theory and appeals mainly to the designer of furnaces, while the present one is devoted primarily to practice, and should be of interest to those who select furnace equipment, those who install and sell furnace equipment, as well as to furnace operators. The text is divided into seven chapters headed as follows: Fuels and Sources of Heat Energy; Combustion Devices and Heating Elements; Control of Furnace Temperature; Control of Furnace Atmosphere; Labor-saving Appliances; Critical Comparison of Fuels and of Furnace Types; and Selection of Fuel and Furnace to Suit Plant Conditions.

CRAIN'S MARKET DATA BOOK AND DIRECTORY OF CLASS, TRADE, AND TECHNICAL PUBLICATIONS. 500 pages, 6 by 9 inches. Published by G. D. Crain, Jr., 537 S. Dearborn St., Chicago, Ill. Price, $5.

This is the 1925-1926 edition of this market data book and directory of publications. A number of changes and improvements have been incorporated in the new edition. The arrangement is the same as in previous editions, the first section containing an index to markets, which is followed by an alphabetical list of publications, and then by the principal section of the book containing the market data and directory information. A list of publications that serve each field of industry is given, together with the name and address of the publisher, subscription price, page size, circulation, advertising rates, and other pertinent data. In addition to the figures showing total circulation, the distribution of circulation by classes of readers is also shown in this edition. Separate sections are devoted to Canadian and foreign publications.

CONDENSED CATALOGUES OF MECHANICAL EQUIPMENT (1925-1926). 826 pages, 8½ by 11½ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City. Price, $5.

This is the fifteenth edition of this catalogue and directory of mechanical equipment. The present edition shows a gain over the previous issue, having a total of 585 pages of catalogue data carried by 479 firms. The book contains over 2600 illusrations. There are three main sections in the volume—a classified catalogue section, a general classified directory of manufacturers in the mechanical field, and a professional engineering service directory. The catalogue section contains condensed catalogue information covering the products of manufacturers of various classes of mechanical equipment. The classified directory comprises a specialized cross-indexed list of mechanical equipment with the names and addresses of manufacturers. This section contains the names and addresses of over 4400 firms listed under about 5000 classifications of equipment. The professional engineering service directory contains a classified list of members of the American Society of Mechanical Engineers engaged in the various branches of professional engineering practice, together with condensed catalogue information describing the field and service of engineers in this field.

BRITISH WIRE-DRAWING AND WIRE-WORKING MACHINERY. By H. Dunell. 188 pages, 7½ by 11 inches. Published by Constable & Co., Ltd., 10 Orange St., Leicester Square, W C 2, London, England, and distributed in the United States by the D. Van Nostrand Co., 8 Warren St., New York City. Price, $8.50.

It is stated in the preface of this book that the British wire-working industry consumes, roughly, a quarter of a million tons of steel annually and about half as much of the non-ferrous metals. Despite the importance of this industry, there exists very little literature on the subject of wire and wire manufacture, and it is to fill the need for information on this subject that this book has been brought out. The practice described is, of course, that followed in British shops. The twenty chapters into which the material is divided cover the following subjects. The Manufacture of Wire Rods; Wire Drawing; Dies; Wire-drawing Blocks; Continuous Wire-drawing Machines; Straightening and Cutting-off Machines; Wire Factories; Wire-netting Machinery; Wire-weaving Looms; Electric Cable Making; High-speed Stranding Machines; Barbed Wire Machines; Nail and Rivet Making Machines; Pin-making Machines; Needle Making; Safety-pin Making; Wire Chain Making; Wire Flattening; and Miscellaneous Machines.

NEW CATALOGUES AND CIRCULARS

PORTLAND CEMENT ASSOCIATION, 111 W. Washington St., Chicago, Ill., is distributing sheets showing recent concrete structures of note.

CALENDAR. Abrasive Co., Bridesburg, Philadelphia, Pa., manufacturer of grinding wheels and polishing grain is distributing to the trade a calendar for 1926.

MACHINE TOOLS. J. L. Lucas & Son, Inc., Bridgeport, Conn. List No. 65 of the new and rebuilt machine tools that this company has in stock.

GEARED-HEAD LATHES. R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. New lathe catalogue, covering the latest design of LeBlond geared-head lathes.

ELECTRIC MOTORS. Wagner Electric Corporation, St. Louis, Mo. Bulletin 137, illustrating and describing Wagner wound-rotor slip-ring polyphase motors.

CALENDAR. Union Switch & Signal Co., Swissvale, Pa., manufacturer of drop-forgings, is distributing a calendar for 1926, containing three months on each sheet.

STEAM TURBINES. General Electric Co., Schenectady, N. Y. Bulletin GEA-235, descriptive of General Electric steam turbines, with ratings of 500, 600, and 750 kilowatts.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Sheet for loose-leaf catalogue, illustrating the application of New Departure ball bearings in vacuum pumps.

MONEL METAL AND NICKEL. International Nickel Co., 67 Wall St., New York City, is distributing a directory of manufacturers of monel metal and nickel products.

ELECTRIC LIGHT FIXTURES. O. C. White Co., 15-21 Hermon St., Worcester, Mass. Catalogue 26, illustrating the line of adjustable electric light fixtures made by this concern.

"TEXROPE" DRIVE. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin 1228, descriptive of the Allis "Texrope" drive, a flexible and positive multiple belt drive for close centers.

SCALES. Toledo Scale Co., Toledo, Ohio. Folder illustrating various types of Toledo automatic dial scales for weighing, computing, counting, mailing, checking, packing, shipping, etc.

EXPANDING REAMERS. Wetmore Reamer Co., Milwaukee, Wis. Catalogue 22, illustrating and describing expanding reamers of different types, as well as reamer blades and arbors.

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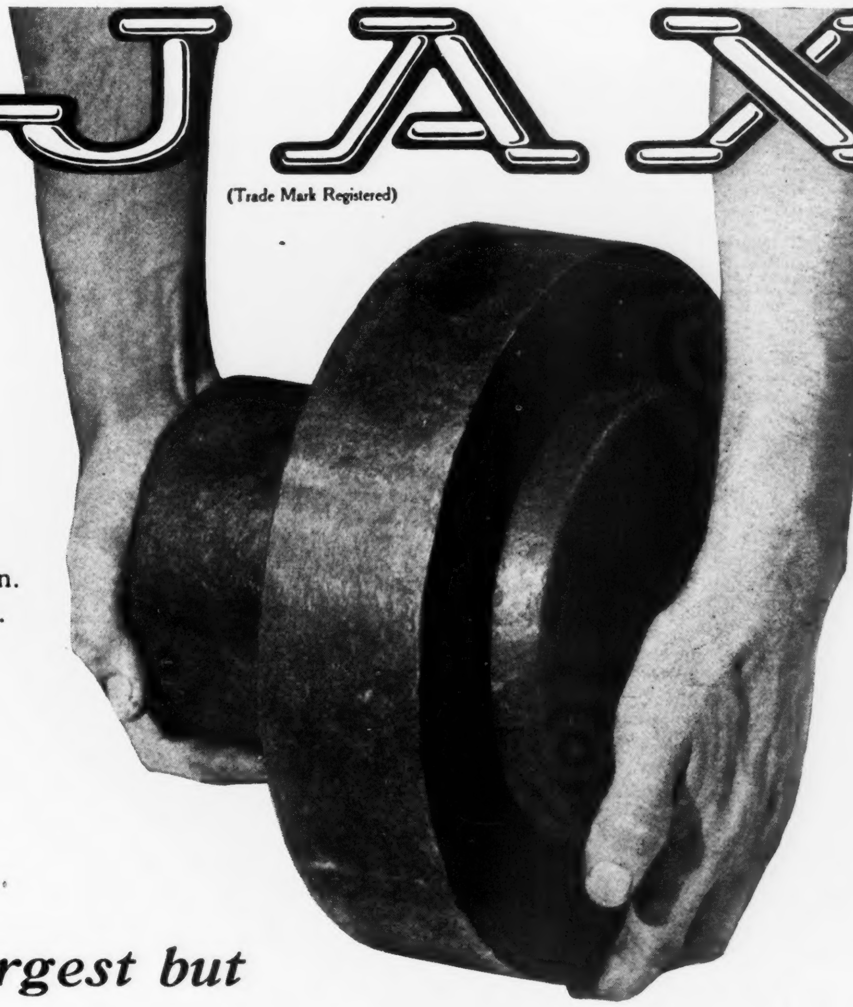

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CALENDAR. Whitman & Barnes Mfg. Co., Akron, Ohio. Large wall calendar arranged with three months on each sheet, and containing an illustration of W & B twist drills and reamers.

FANS. American Blower Co., Detroit, Mich. Bulletin 6103, containing data on the American H. S. single-inlet fan, which was designed to meet the demand for a fan suitable for direct-connected motor drive.

WATER DISTILLING EQUIPMENT. Griscom-Russell Co., 90 West St., New York City. Fifth edition of a pamphlet entitled "Raw Water Distilling Plants for Producing Distilled Boiler Feed Make-up Water."

PLANERS. Cleveland Planer Co., 3148 Superior Ave., Cleveland, Ohio. Circular illustrating and describing Cleveland open-side planers, which are made in seven sizes for which complete specifications are given.

BLOWERS AND EXHAUSTERS. Allen & Billmyre Co., Inc., 730 Grand Central Palace, New York City. Bulletin 130, illustrating and describing "Tabco" blowers and exhausters of the horizontal multi-stage centrifugal type.

ROLLER-BEARING MOTORS. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin 1132, treating of Allis-Chalmers types AR and ARY polyphase induction motors with cast-steel frames and Timken tapered roller bearings.

HARDENING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular containing a list of installations of the hump method of hardening tools, as well as illustrations showing a number of typical installations.

CALENDAR. New Departure Mfg. Co., Bristol, Conn., manufacturer of ball bearings, is distributing a large wall calendar showing a picture of the plant and arranged so that the calendar for three months can be referred to at one time.

IRON, STEEL, WIRE, ETC. Oliver Bros., Inc., 71 Murray St., New York City. Circular containing table of market values of iron, steel, wire, and metal materials; monthly average prices are given from December, 1897, to September, 1925.

UNIVERSITY OF DELAWARE, Newark, Del. Bulletin of the university for July, 1925, containing the president's report for the year 1924-1925. Bulletin containing financial statement of the university for the year ending June 30, 1925.

STEEL PRODUCTS. Moltrup Steel Products Co., Beaver Falls, Pa. Catalogue 2, containing dimensions, prices, and other data on Moltrup steel products, including cold-drawn steel, turned and polished steel, machine keys, machine rack, and flattened steel plates.

FLOW METERS. General Electric Co., Schenectady, N. Y. Bulletin GEA-10, containing information on the construction, principle of operation, and application of G-E mechanically operated flow meters for measuring fluids and gases.

WELDING SUPPLIES. Lincoln Electric Co., Cleveland, Ohio. Catalogue covering supplies for electric "Stable-Arc" welding machines, including cables, glass, shields, welding electrodes, aprons, gloves, brushes, electrode-holders, and other accessories.

HEAT-TREATING EQUIPMENT. Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill. Folder entitled "Steel and its Heat-Treatment," containing the first of a series of articles giving technical information on the heat-treatment of steel.

CHAIN-MAKING MACHINES. Baird Machine Co., Bridgeport, Conn. Bulletin illustrating and describing Baird chain-making machines, automatic power presses, foot presses, wire-forming machinery, tumblers, burnishing machines, and fanning mills.

SPEED REDUCERS. Boston Gear Works Sales Co., Norfolk Downs, Mass. Booklet entitled "Modern Speed Reduction," containing data on Boston standardized speed reduction units. The pamphlet contains dimensions and prices for the various types and sizes.

WATER LEVEL INDICATOR. W. B. Connor Co., Inc., 110 W. 42nd St., New York City. Circular descriptive of the "Ace" water level indicator for boiler plants. The device is suited for remote indicating, and can be installed at any convenient location in the plant.

WORM-GEARING. Cleveland Worm & Gear Co., 3258 E. 80th St., Cleveland, Ohio. Bulletin 105, illustrating and describing Cleveland worm-gear drives. Applications of these drives to various industrial uses are shown, and tables of standard dimensions are included.

TESTING MACHINES. Herman A. Holz, 17 Madison Ave., New York City. Bulletin 34, dealing with the advantages of the design and construction of the "Amsler" tensile testing machines, and the checking of the calibration of the testing machines over their entire range.

CENTRIFUGAL PUMPS. De Laval Steam Turbine Co., Trenton, N. J. Bulletin descriptive of the installation of two De Laval turbine-driven centrifugal pumps in the Mohawk Pumping Station at Tulsa, Okla., by means of which 24,000,000 gallons of water per day are supplied to the city.

STEEL FITTINGS. Walworth Mfg. Co., Boston, Mass. Walworth Bulletin No. 2, containing the description of a test made to determine the physical properties of Walworth "Sigma" steel flanged fittings. The fitting tested was a 4-inch, 400-pound working steam pressure flanged tee.

SCREW MACHINES. Foster Machine Co., Elkhart, Ind. Case No. 8 of the Foster Production Engineering series shows tooling equipment used on the Foster No. 7 friction head screw machine for machining automobile clutch gears. Figures covering the actual savings effected with this equipment are given.

CHECK VALVES. Smolensky Valve Co., Inc., Cleveland, Ohio. Bulletin 2, descriptive of Smolensky noiseless flanged check valves, designed to eliminate water hammer on any pump where a check valve is required, and to eliminate all noise or chatter on steam lines, water systems, vacuum pumps, etc.

FIREBRICK CEMENT. Botfield Refractories Co., Swanson & Clymer Sts., Philadelphia, Pa., has issued a series of circulars showing the advantages of "Adamant" firebrick cement for furnace construction. Each circular shows the savings effected in a different factory where this cement was used.

RECORDING AND INDICATING GAGES. Uehling Instrument Co., 473 Getty Ave., Paterson, N. J. Bulletins 118 and 118-A, illustrating and describing, respectively, the "Apex" carbon-dioxide recorder, and the "Apex" carbon-dioxide meter used in connection with the indicating and recording gages.

MICARTA. Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Folder on micarta products, containing a sample of real micarta punched so as to show both ordinary and unusual punchings that might be necessary for industrial uses. The various uses to which micarta can be put are listed.

ROLLER BEARINGS. Hyatt Roller Bearing Co., Newark, N. J. Dimension and load bulletin No. 1559, containing information on types of Hyatt roller bearings that will enable the engineer to readily choose the bearing best suited for a given installation. Tables of basic capacities and dimensions are included.

MOLYBDENUM STEEL BALLS. Standard Steel & Bearings, Inc., Plainville, Conn. Pamphlet entitled "The Burden Bearers," in which is described the process of forging molybdenum steel balls for bearings, and the steps taken to insure accuracy of the product combined with the ability to carry heavy loads for long periods.

COUNTERBORES. Gairing Tool Co., Inc., Detroit, Mich. Circular illustrating Gairing counterbore sets—the type A set being provided with a hexagon drive and the type B with a ball drive. The sets are made up with tools that enable any sized hole from 1/4 to 2 inches in diameter to be counterbored or spot-faced.

WATER SOFTENERS. Power Plant Specialty Co., 440 S. Dearborn St., Chicago, Ill. Bulletin 110, containing data on water for boiler feed use under conditions of high pressures and overloads. The bulletin describes the results that have been obtained in five different plants, with the water softening system made by this company.

OIL BURNERS. American Oil Burner Association, 350 Madison Ave., New York City. Bulletin covering the methods and procedure in oil burner testing wherever burners are fired under boilers or in warm air heating plants. Tables and formulas for testing burners are included. Copies may be obtained from the association at 75 cents each.

SPEED-REDUCING GEARS AND LIGHT TRANSMISSION MACHINERY. Winfield H. Smith, 116 Eaton Street, Springville, N. Y. Catalogue 22, illustrating and giving data on speed-reducing gears, pillow blocks, arbor presses, hangers, pulleys, couplings, etc. Several new products are shown in this catalogue. Illustrations of typical installations are included.

ELECTRICAL INSULATING MATERIALS. Mitchell-Rand Mfg. Co., 18 Vesey St., New York City, is distributing to those interested in insulating materials the M-R wall sheet, containing tables frequently used in electrical and machine shops, including tap drill sizes, dimensions of twist drills and machine screws, decimal equivalent tables, Centigrade-Fahrenheit conversion tables, copper wire tables, and a list of common insulating materials.

VALVES. Hydraulic Press Mfg. Co., 48 Lincoln Ave., Mount Gilead, Ohio. Descriptive folder of the high-pressure "Forgsteel" valve, constructed of forged steel, the valve body having a uniform section throughout to insure uniform expansion and contraction. The seat disk and stem are made of non-corroding, acid-resisting steel or "Monel" metal. The packing nut is also of "Monel" metal and the yoke is of steel. This valve is designed exclusively for high-temperature and high-pressure work.

MILLING MACHINES. Kempsmith Mfg. Co., Milwaukee, Wis. Catalogue 50, covering the line of milling machines made by this company, and giving examples of typical jobs performed on Kempsmith "Maximillers," together with data regarding the work, equipment, and production time. In addition to complete specifications for the various sizes, information is given on the tools and attachments used with these machines, as well as tabular data useful in connection with milling operations, such as index tables used with universal dividing heads; change-gears and angle for spirals; index table for differential indexing; tables of leads for spiral cutting on the universal dividing head; and a variety of other useful information.

MILLING MACHINES. Kearney & Trecker Corporation, Milwaukee, Wis. Bulletin 25, describing the construction and special features of Milwaukee milling machines. Bulletins 102M to 105M, inclusive, illustrating Milwaukee plain, universal, and manufacturing milling machines, equipped with motor-in-base drive. Bulletins 107B, 108B, and 201B, illustrating the 2-A manufacturing milling machine, the 2-B plain milling machine, and the 1-A vertical milling machine, with belt drive. Bulletin 204M, illustrating the No. 2-B vertical milling machine with motor-in-base drive. Bulletins 150 to 152, inclusive, containing specifications for Milwaukee manufacturing, plain, and universal machines, with belt and motor drives. Bulletin 250, containing specifications for Milwaukee vertical milling machines with belt and motor drives.